A STUDY ON USE OF URINE DIPSTICK AS A RAPID SCREENING TOOL FOR EVALUATION OF UTI IN CHILDREN

Dissertation Submitted For

M.D DEGREE EXAMINATION

MAY – 2018

BRANCH – VII - PAEDIATRIC MEDICINE

INSTITUTE OF CHILD HEALTH AND RESEARCH CENTRE

MADURAI MEDICAL COLLEGE, MADURAI.

THE TAMILNADU

DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI

TAMILNADU.

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled **"A STUDY ON USE OF URINE DIPSTICK AS A RAPID SCREENING TOOL FOR EVALUATION OF UTI IN CHILDREN"** submitted by **DR.ANUREGA SELVARAJ** to the Faculty of Paediatrics, The Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the university regulations of the Tamil Nadu Dr. M.G.R Medical University, Chennai, for M.D Degree **Branch VII – PAEDIATRIC MEDICINE** examination to be held in May 2018.

DR. D.MARUTHUPANDIAN
M.S., FICS., FAIS.,
Dean, Madurai Medical College,
Government Rajaji Hospital,
Madurai – 625020

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled" **A STUDY ON USE OF URINE DIPSTICK AS A RAPID SCREENING TOOL FOR EVALUATION OF UTI IN CHILDREN"** submitted by **Dr. ANUREGA SELVARAJ** to the faculty of Pediatrics, The Tamil Nadu Dr. M.G.R Medical University, Chennai in partial fulfillment of the requirement for the award of M.D Degree **Branch VII (PAEDIATRIC MEDICINE)** is a bonafide research work carried out by her under our direct supervision and guidance.

Dr. K.MATHIARASAN MD, DCH.
Director& Professor of pediatrics,
Institute of Child Health Research Centre,
Madurai Medical College,
Madurai.

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled" **A STUDY ON USE OF URINE DIPSTICK AS A RAPID SCREENING TOOL FOR EVALUATION OF UTI IN CHILDREN"** submitted by **Dr. ANUREGA SELVARAJ** to the faculty of Pediatrics, The Tamil Nadu Dr. M.G.R Medical University, Chennai in partial fulfillment of the requirement for the award of M.D Degree **Branch VII (PAEDIATRIC MEDICINE)** is a bonafide research work carried out by her under our direct supervision and guidance.

Dr. S.SHANMUGASUNDARAM MD, DCH.
Professor of pediatrics,
Institute of Child Health & Research Centre,
Madurai Medical College,
Madurai.

DECLARATION

I, **Dr. ANUREGA SELVARAJ**, solemnly declare that the dissertation titled "**A STUDY ON USE OF URINE DIPSTICK AS A RAPID SCREENING TOOL FOR EVALUATION OF UTI IN CHILDREN** " has been conducted by me at Institute of Child Health and Research Centre, Madurai under the guidance and supervision of **Prof.Dr.S.SHANMUGA SUNDARAM, M.D., DCH.**

This is submitted in part of fulfilment of the regulations for the award of M.D Degree Branch VII (Paediatric Medicine) for the May 2018 Examination to be held under The Tamil Nadu Dr. M.G.R Medical University, Chennai. This has not been submitted previously by me for any Degree or Diploma from any other University.

Place: Madurai **Dr.ANUREGA SELVARAJ**

Date:

ACKNOWLEDGEMENT

First I would like to thank the almighty for giving me this opportunity. I extend my sincere thanks to the Dean, **Prof.Dr.D.Maruthupandian, M.S, F.I.C.S., F.I.A.S.,** Government Rajaji Hospital, Madurai, for permitting me to conduct this study and utilize the institutional facilities.

I express my sincere thanks and gratitude to **Prof. Dr. K. Mathiarasan**, Professor and Director, Institute of Child Health & Research Centre, Madurai, for his able supervision, encouragement, valuable suggestions and support for this study.

I am greatly indebted to my teacher, **Prof. Dr. S.Shanmugasundaram,** who guided me throughout my study. I am also greatly thankful for his able supervision, critical review, constant encouragement and full support rendered in every aspect of this study.

I would like to thank **Prof. Dr. M.Nagendran**, who guided me to a great extent throughout the study.

I would extend my sincere thanks to,

Prof. Dr. S. Balasankar, **Prof.Dr.M.S. Rajarajeshwaran,**

Prof.Dr.Kulandaivel, Prof.Dr.Nandhini and

Prof.Dr.M.Balasubramanian

for their valuable advice and encouragement at every stage of this study.

I wish to express my sincere thanks to my Assistant Professors of Pediatrics, **Dr. P. Guna** and **Dr .S. Murugesalakshmanan** for their constant guidance, encouragement and support throughout my study.

I also extend my thanks to **Dr. E. Sivakumar, Dr. D. Rajkumar, Dr. J. Balasubramanian, Dr. P. Murugalatha,**

Dr. P. Ramasubramaniam, Dr. K. Ramya, Dr. P. Kannan,

Dr. S. Suresh for their guidance, supervision, valuable suggestions and support throughout this study.

I thank the Institutional Ethical Committee for granting me permission to conduct the study. I also express my gratitude to all my fellow **Postgraduates** for their kind cooperation in carrying out this study and for their critical analysis.

I express my thanks to my parents, my sister and other members of my family for their support throughout my study.

Last but not the least, I submit my heartfelt thanks to the children and their parents for extending full co –operation to complete my study successfully

CONTENTS

INTRODUCTION

INTRODUCTION

Urinary tract infection is one of the most frequently encountered genitourinary disease in pediatric department. Prompt and accurate diagnosis and management is of major concern, because of the fear of dangerous sequelae like renal scarring, hypertension and end stage renal failure.

UTI has a variable symptomatology. The clinical diagnosis of urinary tract infection is difficult due to the non specific symptoms seen in children. Hence, the diagnostic studies play an important role in aptly detecting the disease.

The diagnostic evaluation of urinary tract infection has been a drifting field with innumerable progressions towards the non invasive method for quicker and accurate diagnosis.

Accurate diagnosis is essential not only to identify, treat and evaluate the child at risk of renal damage, but it is also essential to avoid unnecessary treatment for children who are not at risk of renal damage. This will bring out down the need for unnecessary interventions with undue cost.

Urine samples contribute to a major proportion of samples tested in routine diagnostic laboratories. Many diagnostic facilities like microscopy, gram stain, automated assays and urine cultures are available.

Urine culture is costly, and takes at least 18 hours for growth of organisms in culture medium and thus takes 24-48 hours after presentation of symptoms for results.

On the brighter side, use of reagent strip testing of urine sample is a method which allows early detection of infection in the emergency department and thus allows an earlier initiation of the treatment. Reagent strips have been designed to test markers of infection. Leukocyte esterase and nitrite have been combined on one dipstick to screen urine samples for urinary tract infections. These rapid diagnostic tests can easily rule out urinary tract infection, are economical, less time-consuming and are useful in small laboratories without culture facility. These dipsticks can be used even in primary health centre and school health screening for urinary tract infection.They are more faster in diagnosing complicated and uncomplicated UTI than culture . Sterile urine sample is not required for dipstick test. So it is easy to collect sample in children by noninvasive method. There is no requirement of trained staff and well equipped laboratory, for dip stick method of diagnosing UTI.

Also, use of rapid urine dipstick is found to be effective in selecting the apt cases for sending urine culture and thus avoiding unnecessary expenditure. Thus, urine culture which still remains as the gold standard can be reserved in conditions with strong clinical suspicion, positivity in dipstick.

Although, there are quiet some studies in this regard, there are very few studies in Indian scenario, especially in pediatric population that too with a good sample size. Also, studies which include UTI in congenital abnormalities of urinary tract are meagre in number.

Hence, this study is done in an attempt to contribute to the lacuna.

REVIEW OF LITERATURE

REVIEW OF THE LITERATURE

1) A study was conducted by Nayak et al [2] in the year nov 2004 to oct 2005 in the department of paediatrics, SSG hospital, Baroda which was published in the Gujarat medical journal, 2010.

The study was conducted on 60 children under 2 years of age, inclusion criteria being all children with features of UTI, all severely malnourished children with positive urine culture, all patients of nephrotic syndrome, and those with urinary tract abnormalities with clinical features suggestive of UTI.

Dipstick, urine microscopy, urine culture, USG abdomen was done in all cases .Renal scan was done as needed. Urine culture was taken as the gold standard.

It was found that sensitivity using dipstick compared to microscopy was 68 % vs 63.5% .PPV of dipstick and microscopy was 71.4% vs 70%. Based on this study, there was high false positive values while combining dipstick and microscopy than with dipstick alone.

2) Gorelick and Shaw et al[8] conducted a cross sectional study in urban tertiary care children's hospital emergency department from 1994-1996,which got published in the American academy of Pediatrics in the year 1998 .

This study was done to compare the rapid screening abilities of urine dipstick, combination of dipstick and microscopy, microscopy and Gram stain and Gram stain alone to detect UTI and to compare the costs and outcomes of these tests.

Dipstick was done on 3873 cases and culture were sent for all cases. The use of leukocyte esterase and nitrite by dipstick and Gram stain was found to have higher specificity with fewer false-positive results, good negative predictive value. It concluded that dipstick followed by culture was the most cost effective one.

It concluded that even though urine culture is the gold standard for diagnosing UTI, dipstick is considered to be cheaper and faster screening test which can be carried out in OPD and office set up where lab facilities for microscopy are not available.

3)Another study was done by Mod Hk et al[13] in the department of Paediatrics, GCS medical college hospital and research centre, Ahmedabad, Gujarat, India in the year 2013-2014.This was published in the International Journal of Contemporary Paediatrics in 2017 .

This study was done on 60 children with clinical suspicion of UTI. Fever was detected as the most common presenting complaint followed by burning micturition. Urine sample was examined for microscopy, dipstick and culture and USG abdomen was done on all cases.

There was significant correlation between combined leukocyte esterase and nitrite to urine culture. In order of sensitivity, combined dipstick >nitrite >LE >microscopy .Nitrite was found be the most specific.

An additional finding was found in this study .Most common USG finding was hydronephrosis followed by cystitis, calculi, medical renal disease.

It concluded that dipstick was better than microscopy for early diagnosis of UTI and above all urine culture remains the gold standard.

4)Mori et al [(27)]conducted a systemic review comparing the urine dipstick in infants vs older children and urine dipstick vs microscopy .

2 studies were studied. The study was done to evaluate the effect of age in performance of dipstick testing for UTI and to compare the efficacy of dipstick against microscopy.

Answers to the clinical questions were executed through searching various databases .Two studies out of six compared the performance of dipstick in infants and <2 years with older children.

It was found that to rule out bacteremia in the younger age, performance of dipstick was less reliable than in older children.

The author is of the opinion that this age related variation in performance of dipstick could be because of changes in bacterial colonisation, susceptibitity, host response to infection, clinical

presentation, use of diapers and difficulty in urine collection in children who are not yet toilet trained.

The study concluded that urine dipstick testing on fresh samples can be useful for urinary tract infection >2 years and not in< 2 years and the dipstick was better than microscopy.

5) Another study was done by Eric et al[26] in the department of Paediatrics and Research Enterprise, University of Utah, Salt lake city between 2004 -2011. This study compared dipstick to microscopy and urine culture.

This study was done in 13, 030 febrile infants 0-90 days old .6394 had all the test performed and 770 had culture positive UTI .Positive predictive value of dipstick was found to be higher than microscopy.

This study concluded that urine dipstick test can be used as a standalone test in febrile infants, while awaiting urine culture.

6) The University of Yolk ,published a bulletin in 2004 , regarding the diagnosis of UTI in under 5 children. This article quotes that 39 studies were done for urine dipstick and 107 datasets assessed the usefulness of urine dipstick test for nitrite, leukocyte esterase, protein, glucose, blood.

The research suggested that leukocyte esterase and nitrite testing appears to offer the best performance for ruling out the disease.

There was no use of urine glucose in UTI. There was insufficient information to make any judgement regarding the overall diagnostic accuracy of dipstick for protein, blood.

7) Another study was done in the department of Pediatrics, Rajah Muthiah Medical College, Tamil Nadu, India in 2014, which was published in the International Journal of Science and Research.

The study tries to establish the relevance of urine dipstick analysis and microscopy in detecting UTI .100 patients with suspected urinary tract infection were studied. Dipstick was done for leukocyte esterase, nitrite and albumin. Microscopy was done for bacteriuria, hematuria, pyuria.

It was detected that LE had good specificity and sensitivity. Nitrite had good specificity and positive predictive value Pyuria and bacteriuria was found to have good specificity and positive predictive value. Hematuria had poor predictive value for UTI .Albumin was found to have no role in detecting UTI.

This study concluded that nitrites and bacteriuria has a positive predictive value of 93.1% and combined specificity of 95 % .Leukocyte esterase and nitrite have a combined sensitivity of 82 % and negative predictive value of 83 %.

Thus, combination of leukocyte esterase and nitrite are reliable parameters for early detection of urinary tract infection in children .

8) Another study was done in 2012 by Ruchika et al [23]in the Department of microbiology, Fortis health care, Haryana, India .It was an observational study done on 67 urine samples.

The aim of the study was to evaluate the efficacy of dipstick in detecting UTI. Parameters like leukocyte esterase, nitrite and proteinuria using dipstick and urine culture was done. This study estimated that sensitivity was highest for Leukocyte esterase, nitrite and proteinuria followed by Leukocyte esterase and proteinuria, nitrite and proteinuria and leukocyte esterase and nitrite and finally leukocyte esterase.

Specificity and negative predictive value were found to be high for combined LE and nitrite. Thus the study concluded that dipstick can be safely used to exclude UTI than to diagnose UTI .

9) Another study was done by Ramazan et al [4] in the Duzca University, School of Medicine, Department of Biochemistry in 2010 .It was published in the European journal of General medicine, 2010

The aim of the study was to compare the effectiveness of dipstick analysis with microscopic analysis and to compare these both with urine culture.

250 morning samples were collected. Dipstick, microscopic examination and culture was done in all of them .35% had urine culture positivity.

Sensitivity and specificity of microscopy was 91% and 68% respectively as against 80% and 60% for dipstick method.

This study says that though microscopic examination has fewer false positive and false negative rates than dipstick, one third of the general practitioners does not have a microscope in their busy office practice.

So, dipstick is a rapid test to detect UTI than urine microscopic analysis and cheaper than urine culture in diagnosing UTI.

10) Another study was done in the department of microbiology, Nepal, Koirala Institute of Health Sciences.

It was done to validate the use of rapid nitrite dipstick test against urine culture for diagnosing UTI .Of 202 samples of urine , 46 became rapid nitrite dipstick positive , while 42 were culture positive .Among 42 culture positive,29 were only nitrite positive. Sensitivity , specificity , positive and negative predictive values of rapid nitrite test were 69.04%,89.4%,63%, 41.6% respectively, while that of pyuria were 36%,60%,68%,55% respectively.

It concluded that rapid nitrite test can be used in conjugation with urine culture in the diagnosis of UTI rather than replacing it fully.

11) Ranguiahagari et al did a study to compare the diagnostic value of urine nitrite by dipstick in detecting UTI. It was done in 2014 Jan to 2014 March in bacterio analysis unit of Kigali. This study was done in

1043 mid stream urin samples. Urine culture was found to be positive in 165 patients. Urine dipstick was found to be positive in 61 cases. Sensitivity, specificity, positive predictive value, negative predictive value was 36.6%,99.99%, 98.3%,87.8% respectively .The study concluded that a positive nitrite test should always be considered as UTI .Because of higher specificity , nitrite test can be used in empirical diagnosis and treatment of UTI.

12) Sara Najeeb et al [25] did a study in the Army Medical College, Rawalpindi in the department of microbiology from Jan 2013 to Dec 2013.

300 fresh urine samples were collected and tested for nitrite and Leukocyte esterase. Quantitative cultures were done in all of them. Author was of the opinion that even though urine culture is a gold standard for the diagnosis of UTI, it takes 18 hours for bacterial growth in culture and the diagnosis remains unestablished in 24-48 hours, which may delay the treatment process. It concluded that dipstick as a rapid test allows us to start an early antibiotic regimen while awaiting urine culture.

ANATOMY OF THE URINARY TRACT:

Kidneys are vital organ which perform the essential function of removing waste products from the blood, the regulation of sodium, potassium and other electrolytes, the regulation of fluid balances and

blood pressure, the maintenance of acid-base balance, and the production of various hormones.

The functional unit of the kidney is the nephron, composed of a filtering unit called the glomerulus and its associated renal tubule. Each kidney is comprised of roughly one million nephron. Arterial blood enters the kidney through the renal artery. Blood entering the glomerulus is filtered across the fenestrated glomerular capillary wall, producing an ultrafiltrate that crossed into Bowman's space and then enters the tubular lumen proper. During the transit of this ultrafiltrate thrugh the length of the tubule, its composition is modified by reabsorption and secretion of specific components by the tubular epithelial cells. The end result of this process is the formation of urine, which is transported to the bladder via the ureters, and the concomitant return of cleaned blood to the circulation through the renal vein .

The walls of the ureter contain which are arranged in spiral, longitudinal and circular bundles .Regular peristaltic contractions occurring about 5 times /min pushes the urine from the renal pelvis to the bladder. Synchronous with the peristaltic waves, urine spurts from the pelvis to the bladder The oblique passage of the ureters through the bladder wall keeps the ureters closed, opening up only during the peristaltic waves .This mechanism prevents the reflux of urine from the bladder .

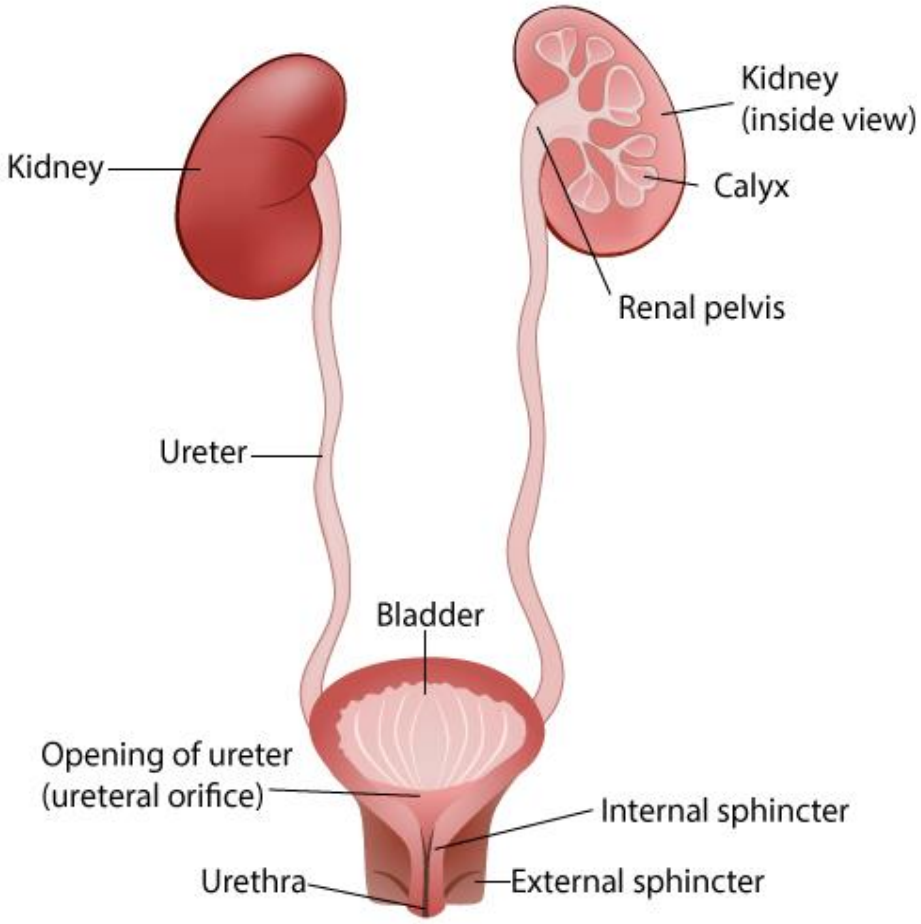

Figure 1 ANATOMY OF URINARY TRACT

The smooth muscle of the bladder has spiral, longitudindal and circular bundles called the detrusor muscles .Detrusor muscles are responsible for emptying the bladder during micturition .Muscle bundles pass on the inner side of the urethra called the internal urethral sphincter but they do not encircle the urethra .External urethral sphincter or the membranous urethra is composed of skeletal muscle fibres located farther along the internal sphincter. The bladder epithelium has superficial flat cells and deep cuboidal cells .

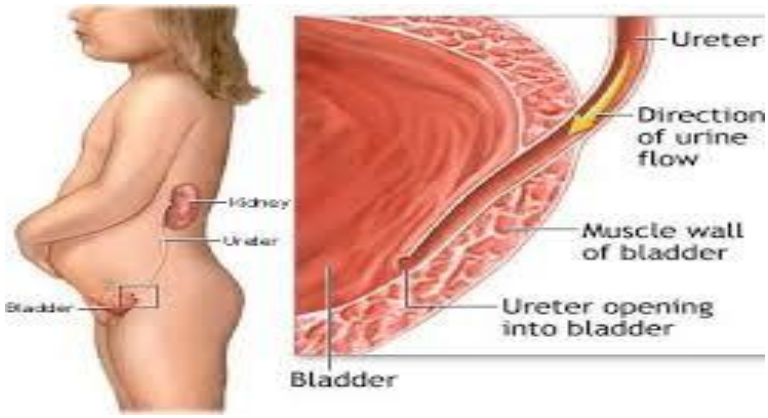

Figure 2 ANTIREFLUX MECHANISM IN THE BLADDER

The parasympathetic innervations to the bladder is through the pelvic nerves S2,S3,S4 .The sympathetic innervation is through the hypogastric nerves L1,L2 ,L3 .The somatic innervations is through the pudendal nerves .The fibres in the pelvic nerves are the afferent limb of the voiding reflex and the parasympathetic fibres in the same fibres are the efferent limb .The integration of the reflex is at the sacral portion of the spinal cord .

PHYSIOLOGY OF MICTURITION:

Micturition is basically a spinal reflex under voluntary facilitation and inhibition.The higher brain functions facilitate and inhibit it .Urine enters the bladder without increasing the intravesical pressure till it is well filled .Bladder muscle has a property of plasticity , that is ,when it is stretched , initially tension rises and then remains static .This is as per law of laplace . This law states that pressure in the a spherical viscus is equal to twice the wall tension divided by radius .In the bladder the

tension increases when the bladder gets filled ,but the radius also increases .So pressure only slightly elevates with the filling of the bladder.

During micturition, detrusor muscle contracts, perineal muscles and external urethral sphincters are relaxed ,urine passes through the urethra . The first urge to void is felt at a bladder volume of 150 ml. There is a marked sense of fullness at 400 ml.

The mechanism of how a voluntary micturition is initiated is still unclear .The initial event is the relaxation of the pelvic floor muscles.This causes the detrusor muscle to contract through a downward tug .The perineal muscles and external sphincter voluntarily contracts preventing the passage of urine down the urethra, or interrupating the passage of urine after the commencement of micturition .The adults have the learned ability to delay the micturition till the opportunity to void occurs by keeping the external sphincter at a contracted state .But it is difficult in children especially less than 2 yrs .In females after urination , urethra empties by gravity .In males ,urine is expelled by several contractions of bulbocavernosus muscle .

Urinary tract can be divided as upper and lower urinary tract .Upper urinary tract is formed by kidney and the ureter .Lower urinary tract is formed by the bladder and the urethra.

URINARY TRACT INFECTION:

Urinary tract infection is the inflammation of the urothelium to the bacterial invasion.

There are three forms of UTI:1)Asymptomatic bacteriuria 2)Cystitis 3)Pyelonephritis .Other less common manifestations are renal abscess and focal pyelonephritis or nephronia .

EPIDEMIOLOGY:

The prevalence of UTI greatly varies with age.The incidence of UTI in preterm neonate is approximately 3% and term neonate is 1 % The usual age of occurrence of the first symptomatic UTI is in infancy especially in male child .Also ,there is increased incidence of UTI in uncircumscrised male child .Ratio of male :female UTI in <1 yr is 2.8-5.4 :1 .UTI occurs in 1% of boys and 1-3 % of girls .Ratio of male :female UTI beyond 1-2 years of age is 1:10 .First UTI in girls occur in 5 yrs of age with peak occurring during infancy and toilet training. It is understood from the population based studies that by 7 year of age , 7% girls and 2 % boys have atleast one episode of UTI .The incidence of UTI in febrile infants and young children is approximately 7 % .5- 10% of children investigated for UTI show obstructive lesion esp boys and 30% show vesicoureteric reflex .The presence of UTI below 2 years , presence of VUR or obstructive lesions ,delay in starting the treatment

are all risk factors for renal scarring . In 50% of cases, symptomatic UTI turns out to be recurrent UTI .UTI is primarily caused by colonic bacteria.

DEFINITIONS IN UTI:

1) SIGNIFICANT BACTERIURIA : Colony count > 10^5 CFU /ml of single bacterial species in mid stream clean catch of urine

2) ASMPTOMATIC BACTERIURIA :

Significant bacteriuria without symptoms of UTI is called asymptomatic bacteriuria.

3) RECURRENT UTI:

A second episode of UTI with the same or different organism following the clearance of the original UTI is called recurrent UTI

4) SIMPLE UTI:

Dysuria, frequency of micturition, without fever is called simple UTI. It implies lower urinary tract infection.

5) COMPLICATED UTI:

It is characterised by high grade fever >39 ^{0}c, systemic toxicity ,persistant vomiting, dehydration ,renal angle tenderness,and raised serum creatinine levels.It implies upper urinary tract infection.It is associated with structural or functional urinary tract obstruction

6) RELAPSE:

Recurrent UTI with the same organism that has not been adequately cleared.

ETIOLOGY:

In girls, Ecoli is the most common organism causing UTI, constituting about 75-80%, whether first symptomatic episode or recurrent UTI .This is followed by Klebsiella spp ,then by proteus .Ecoli is also common in boys , but above 1 year both Ecoli and proteus equally common followed by gram positive organisms. Staphylococcal saprophyticus and enterococcus are equally common in both sexes. Other uncommon organisms are staphylococcus aureus, group B streptococcus and Staphylococcus epidermidis. Proteus and Pseudomonas are associated with recurrent UTI, instrumentation, urolithiasis and nosocomial infections .Fungal infections esp Candida albicans and pathogens of low virulence are the causative organisms in immuno compromised individuals .Candida albicans are also common in preterms and following prolonged antibiotic therapy .

Bryant and colleagues steted that the overall incidence of Candida was 0.5%.[(29)] Phillips and Karlovics in their study found it to be 42[29]

Viral infections causing UTI ie cystitis are also common – adenoviral infections are the most common of these causing gross hematuria .The normal commensal bacterial flora esp Lactobacillus which is present in the periurethral region prevents the virulent organisms from epithelial attachment. Hence, the use of broad spectrum antibiotics

to eliminate the periurethral flora and the colonisation with uropathogenic enteric organisms may predispose to UTI .

The risk factors of UTI [1] are Female gender, Uncircumcised male, Vesicoureteral reflux, Bacteria with P fimbriae,ureteric stones, Toilet training ,Voiding dysfunction ,Obstructive uropathy ,Urethral instrumentation ,Wiping from back to front in girls , Tight underwear, Pinworm infestation, Constipation, bladder dysfunction .

Bladder instability, constipation and infrequent Voiding as risk factors of uti are supported by two studies .[31,32]

The increased incidence of UTI in girls is due to the short urethra which permits easy entry of bacteria into the bladder .Mothers with bacteriuria may give birth to babies which may develop rapid colonisation by uropathogens leading to UTI .

RISK FACTORS FOR CHILDREN 2-24 MON for acute pyelonephritis:(by AAP Guidelines)

1)RISK FACTORS IN GIRLS:

Age younger than 12 mo

Temperature

>39°c (102.2°f)

Fever for longer than 2 days

Absence of another source of infection

2)RISK FACTORS IN BOYS:

Temperature >39°C (102.2°F)

Fever for longer than 24 hr

Absence of another source of infection

PATHOGENESIS AND PATHOLOGY

Most UTI are ascending infections only .The bacteria colonising faecal flora extend to the perineum , enter the bladder through the urethra .In uncircumscribed boys ,floral organism under the prepuce enters the urethra and ascends up the bladder. The bacteria causing cystitis ascend up the kidney causing pyelonephritis

.If conditions are favourable, acute pyelonephritis can turn up into urosepsis . Bacteremia resulting from primary infection from urinary tract is called urosepsis. Hematogenous spread of infection to the kidneys can also occur as in neonates or from infective endocarditis. Direct extension of infection can occur in the presence of fistula connecting the vagina and the urinary tract or the intestine and the urinary tract.

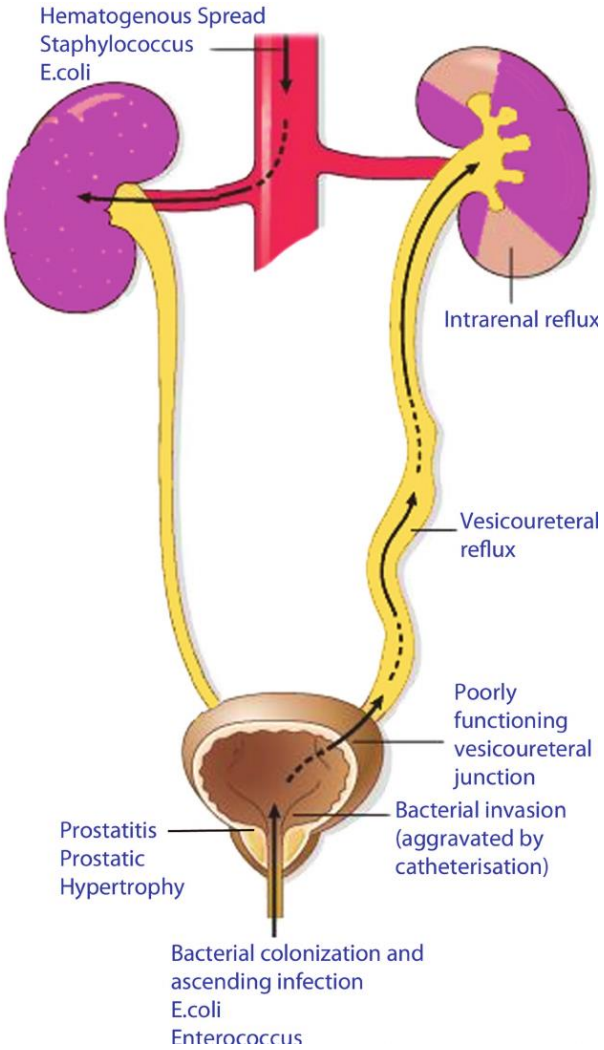

Figure 3 PATHOGENESIS OF ACUTE PYELONEPHRITIS

There is an antireflux mechanism in the simple and compound papillae in the kidney that prevents urine in the renal pelvis from entering the collecting tubules. But some compound papillae in the upper and lower poles of the kidney, allow intrarenal reflux. Then, Infected urine stimulates an inflammatory and immunologic response . The result can cause renal injury and scarring .Child of any age with febrile UTI can cause acute pyelonephritis with renal scarring . Risk is greater in < 2yrs.

Vesico ureteric reflux is an important risk factor for UTI. 1% of the children have vesico ureteric reflux and it is frequently congenital and familial. It is seen that 40-50% of infants and 30-50% of children presenting with urinary infection have reflux but it resolves with age. Risk of scarring and injury, thus leading to reflux nephropathy is increased in first year of life.If it occurs in the intrauterine life, baby develops renal hypoplasia or dysplasia.

If there is grade III, IV, or V vesicoureteral reflux and a febrile UTI, 90% chances are that a child can have acute pyelonephritis on renal scintigraphy or other imaging studies. Urethral catheterization for urine output monitoring or during a voiding cystourethrogram or nonsterile catheterization can introduce a bladder infection. Constipation with fecal impaction can cause bladder dysfunction, thus can increase the risk of UTI.

When the host defense mechanisms are at fault, either local or systemic defense mechanisms , virulence of the invading bacteria overcome the host barriers and cause symptomatic UTI .A lot of bacteria that reach the urinay bladder gets expelled in micturition and few more gets destroted by the bladder epithelial cells .There are yet more defense barriers like secretory Ig A in the urine , some blood group antigens in the urothelial secretions . Presence of blood group antigens, ABO ,Lewis,P on the uroepithelial cell inhibit the bacterial adhesions from

sticking on to the urothelium.Hence in the absence of some blood group antigens ,there is increased susceptibility to UTI .

Breast feeding is a great protection in the first six months of life against UTI. The breast milk secretes anti adhesive factors which comes to play in the urine and maintains the intestinal flora .The bifidus factor in the breast milk allows for the increased growth of lactobacillus .Lactoferrin in breastmilk is bacteriostatic .It binds with iron and makes it unavailable for Ecoli. It also contains bactericidal peroxidises and lipases.

When there is primarily a bladder dysfunction, there is incomplete evacuation of urine . There will some be amount of residual urine . This is the cause of recurrent UTI in whom there is no anatomical abnormalities of the urinary tract or primary vesicourethral reflux. UTIs more often occur at the onset of toilet training in girls, this is because of bladder/bowel dysfunction that occurs at that age. To stay dry, the child tries to retain the urine yet the bladder may have uninhibited contractions. This forces out the urine. This results in high-pressure and turbulent urine flow or incomplete bladder emptying. This increases the chances of bacteriuria. In the toilet-trained child also bladder /bowel dysfunction occurs if they void infrequently. Most School-age children refuse to use the school bathroom due to poor cleanliness , they are the bait for this kind of urinary retention turning to UTI .Obstructive uropathy resulting in hydronephrosis increases the risk of UTI because of urinary stasis .

The first prerequisite in bacterial colonisation of urinary tract is adhesion of the bacteria to the epithelial cells , followed by multiplication and then by induction of inflammation. This bacterial adhesion is mediated by the bacterial fimbriae or pili. These pili are hair like projections containing adhesions at the tip . There are two types of fimbri type 1 and type 2 fimbriae.

The most common organism causing UTI namely the E coli has type 1 fimbriae in most cases. The attatchment of target cells to the fimbriae are blocked by D mannose and hence fimbriae 1 referred to as mannose sensitive . These fimbriae are having no role in pyelonephritris .The fimbriae 2 attachment is not inhibited by mannose and are called mannose resistant . Only certain strains of Ecoli has fimbriae type 2 .

The type II fimbriae has a receptor called glycosphingolipid ,that is present on both the uroepithelial cell membrane and red blood cells . The Gal 1-4 Gal oligosaccharide fraction is the specific receptor. The fimbriae 2 recognise the glycosphingolipid receptor and later bind to them and then recruits the toll like receptors to the urothelial cells

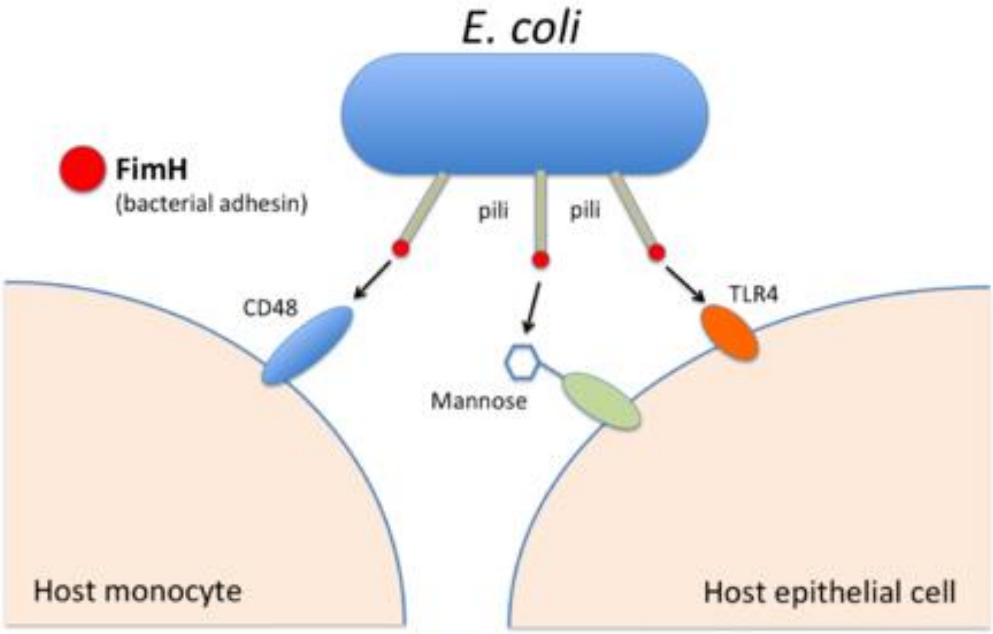

Figure 4 MECHANISM OF ADHESION OF ECOLI FIMBRIAE TO HOST CELL

The toll like receptor gets activated and produces cytokine cascade, this induces the production of adhesion molecules. This causes chemotaxis of leukocytes and produce local inflammation. This pilli in the bacteria helps it adhere to the urothelium and thus ascend into the kidney .This can happen even in a child without vesicourethral reflux.

The fimbriae II can be agglutinated by P blood group erythrocytes, they are known as P fimbriae .These P fimbriae play a vital role in causing pyelonephritis .It is seen that about 76-94 % of the pyelonephritic strains of Ecoli has a P fimbriae while only 19-23% of the cystitis strains have P fimbriae. Certain anatomical and functional abnormalities can prevent a normal voiding mechanism .

1) POSTERIOR URETHRAL VALVE :

It is the most common cause of obstructive uropathy affecting 1 in 8000 boys. The urethral valves are tissue leaflets fanning distally from the prostatic urethra to the external urinary sphincter. The leaflet is separated by slit like opening. The embryologic origin of these valves are unclear. These valves cause varying degrees of obstruction. Approximately 30% of patients experience end stage renal disease or chronic renal insufficiency. The prostatic urethra dilates following which the bladder muscle undergoes hypertrophy. Vesicoureteral reflux can occur in 50% of patients and the chronically distended bladder or bladder muscle hypertrophy can cause distal urethral obstruction. Mild hydronephrosis to severe renal dysplasia can occur . The severity of the disease depends on the severity of the obstruction and its time of onset during fetal development. Earlier the onset in utero, worser is the prognosis. If the degree of obstruction is less ,then the children can present later in life with diurnal urinary incontinence or with UTI. PUV when diagnosed in some older boys, the presentation may be of a poor urinary stream or a diurnal incontinence or a UTI. The vesicourethral reflex if occurs concurrently, it needs to be treated appropriately and with prophylactic antibiotics. If the child encounters a breakthrough UTI, then surgical management considered.

2) NEUROPATHIC BLADDER in children is usually associated with neural tube defects and spinal cord anamolies.The neurogenic bladder can lead to urological consequences like urinary retention, UTI, detrussor sphincter dyssynergia, vesicourethral reflex and hydronephrosis.

During bladder filling, first phase is (1)hyperreflexia with uninhibited contractions at low volumes, (2) normal bladder volume with appropriate contraction (3) Lack of bladder contraction. The sphincter can show (1) reduced or absent tonicity(2)normal tonicity with relaxation during bladder contraction (3) detrusor-sphincter dyssynergia - normal or increased tonicity that increases during a bladder contraction . Bladder compliance may be reduced.This detrusor –sphincter dyssynergia causes functional bladder outlet obstruction, this inturn may lead to bladder muscle hypertrophy and high intravesicular pressure leading to vesicourethral reflux hydronephrosis. Further UTI can complicate the problem.

3) Infrequent voiding due to under active bladder is common in girls . They may void only once or twice instead of 4-7 times per day.This is a behavioural disorder in girls .This in turn leads to urinary retention, bacterial overgrowth leading to recurrent UTI .Sometimes it may lead to overflow of urine, urgency and dribbling. This is treated by prophylactic antibiotics, advice regarding frequent voiding to urine and double

mictutrition can be advised [45].This is followed till a normal pattern of micturition is attained .

4) VAGINAL VOIDING :

In girls with vaginal voiding, when the girl stands up after micturition ,incontinence of urine occurs of about 5-10 ml .The cause may be labial adhesion which in leads to urinary retention which can be managed by adhesiolysis with estrogen cream . It may be common in overweight girls or do not pull down their underwear during voiding.It can prevented by asking the child to keep her legs wide apart during micturition or sit back upright in toilet during micturition.Sexual activity is associated with UTIs in girls.

4) PHIMOSIS :

Phimosis is the inability to retract the prepuce of the penis. Forceful retractions done once or twice in the past may result in cicatrising scar which leads to phimosis. This inturn leads to urinary retention and UTI.

CLINICAL FEATURES:

SYMPTOMATOLOGY:

Fever in UTI is to be given more importance because high grade fever indicates pyelonephritis and fever is absent in cystitis.

Clinical features varies greatly with age ,severity of infection and anatomical location of lesion.

A) NEONATES AND INFANTS:

Neonates and infants with UTI usually develop septicaemia following UTI or UTI following septicemia.

1) Hypothermia

2) Failure to thrive

3) Hyperthermia

4) Irritabi1ity

5) Vomiting

6) Diarrhoea

7) Sepsis , shock

8) Lethargy

9) Persistence of physiological Jaundice

10) Unexplained fever

11) Malodorous urine

B) TODDLERS :

1) Abdominal pain

2) Vomiting

3) Diarrhea

4) Abnormal voiding pattern

5) Malodorous urine[34]

6) Poor weight gain

C) SCHOOL AGE [33]

1) Dysuria

2) Abnormal voiding pattern –secondary incontinence

3) Constipation

4) Dribbling

5) Frequency of micturition , urgency

6) Crying during micturition

7) Malodorous urine

8) Poor stream of urine

9) Pollakiuria(frequent dayb time micturition)

D)ADOLESCENTS:

1) Burning micturition

2) Frequency of micturition

3) Fever

4) Malodorous urine

5) Dysuria

6) Turbid urine

7) Gross hematuria

8) Abdominal pain ,loin pain

SIGNS:

1) Abdominal Examination: To look for suprapubic tenderness, distended bladder, renal mass, palpable fecal mass oin the colon, patulous anus

2) Spinal examination to look for neural tube defect – neurological defect in lower limbs, anorectal malformation

3) Genital examination To look for phimosis, ,labial adhesions (vulval synechiae)

4) Evidence of previous surgery of Urinary tract

1) CYSTITIS :

Involvement of bladder is called cystitis.Symptomatology may include dysuria, increased frequency,abdominal pain , malodorous urine , urgency,incontinence .Fever is not very common in cystitis nor does it cause renal injury . Malodorous urine may or may not occur in UTI .Acute hemorrhagic cystitis is often caused by Ecoli . It is also caused by adenovirus 11, 21. It is a self limiting condition and is more common in boys . It usualy lasts for 4days .

It is often confused with acute glomerulonephritis, but hypertension and abnormal renal function are absent in cystitis.

Eosinophilic cystitis can also occur in children. It is usually common in children with allergic manifestations. It usually presents with hematuria.Imaging shows multiple bladder masses with histology

picture suggestive of inflammatory infiltrates full of eosinophils.The children has propensity to develop ureteral dilatation with hydronephrosis .Bladder biopsy is conclusive to rule out neoplasms.Treatment of choice is antihistamines and non steroidal anti-inflammatory drugs.

Interstitial cystitis is an idiopathic entity. It is common in adolescent girls. It is characterised by dysuria, urgency, pelvic pain, with negative urine cultures .Symptoms are relieved by voiding. It is characterised by bladder mucosal wall ulcers and bladder distension.It is diagnosed by cystoscopic visualisation .Treatment for it involves hydrostatic distension and laser ablation of mucosal ulcers. But no treatment gives satisfactory results.

2) ASYMPTOMATIC BACTERIURIA :

Asymptomatic bacteiuria refers to positive urine culture without any symptoms suggestive of UTI. It is common in preschool and school going children esp common in girls .It is usually detected during routine school health check up. It is very rare to see in boys. It has a prevalence of <1%.This is benign condition not causing renal injury .Organisms detected are also of low virulence type .But in adolescent girls, Ultrasonography is essential to rule out renal anamolies even in asymptomatic bacteriuria as they are at risk for acute pyelonephritis. In pregnant women, if symptomatic UTI is left untreated , then it can lead to renal injury .Sometimes in girls with day or night incontinence or perineal

discomfort due to UTI is misidentified as asymptomatic bacteriuria.It is treated with antibiotics.

3) CLINICAL PYELONEPHRITIS:

It is characterised by fever with chills, malaise,back pain , flank pain, nausea, vomiting , sometimes associated with diarrhea.Sometimes fever may be the only manifestation . It usually presents less than 24 months age group. It should be considered when an infants present with fever without any focus .Symptoms in newborns are non specific in form of irritability , letharginess, refusal of feeds, vomiting, persistant jaundice and weight loss . It is a serious bacterial infection.When these symptoms are present, one should suspect upper bacterial tract infection .When there is involvement of renal parenchyma , then it is called acute pyelonephritis , when there is no renal parenchymal involvement, then it is called acute pyelitis. When renal injury occurs, it is called pyelonephritic scarring.

ACUTE LOBAR NEPHRONIA (acute lobar nephritis) is characterised by a focal renal mass lesion with an acute focal infection without any liquefaction. It is considered an early stage for development of imminent renal abcess. Picture is similar to pyelonephritis. The abnormality can be detected by renal imaging .Renal abcess usually occurs following a pyelonephritis infection. It is caused by either usual

uropathogens or it can occur secondary to hematogenous infection esp staphylococcal infection.

Perirenal abcess usually occurs secondary to infection from perirenal area like psoas abscess or vertebral osteomyelitis, or it can occur from pyelonephritis that dissects the renal capsule.

Xanthogranulamatous pyelonephritis is a rare form of infection which is chatracterised by granulomatous inflammation with foamy histocytes and giant cells .It may manifest as renal mass lesion with chronic or acute lesion.It is caused by renal calculi or obstruction or infection with Ecoli or Proteus species which leads to the development of the lesion . Treatment for the same is partial or total nephrectomy.

RECURRENT UTI:

Recurrence after first episode of UTI is common in 30-50 % of the children. The majority of the infection occurs within 3 months of the previous episode .

It is of three types [48]

- Unresolved bacteriuria – all cultures are +ve for the same organism
- Bacterial persistence – cultures are +ve for the same organism after the urine becomes sterile
- Re infection – cultures are +ve for a different organism after the urine becomes sterile.

Ecoli is the most common organism. Girls of the school going age group may develop recurrent UTI with out any underlying anatomical or functional abnormality of the urinary tract .This kind of UTI is afebrile .But in boys , usually recurrent UTI is uncommon in the absence of the underlying anatomical or functional urinary tract abnormality. One should rule out Vesicourethral reflux, neurogenic bladder, obstructive uropathy, bladder bowel dysfunction. Bladder bowel dysfunction is characterised by recurrent episodes of febrile UTI, constipation impacted stools, high grade VUR, maneuvers to postpone voiding (holding maneuvers – vincents curtsy , squatting)straing or poor stream of urine, thickened bladder wall (>2mm),voiding less than 3 gimes a day or more than 8 times a day. Imaging is essential to detect postvoidal residue of urine >20 ml, spinning top configuration of bladder on MCU. Management involves a multidisciplinary approach involving nephrology, urology.

In a one year longitudinal study (85) recurrent urinary tract infection was seen in 12% of children <five years of age presenting to the emergency department with first episode urinary infection.

DIAGNOSIS OF UTI:

Lab diagnosis is atmost importance in UTI because of the varied symtomatology and nonspecific symptoms.

The gold standard test for the diagnosis of UTI is Urine culture. Urine culture is required to start the therapy.There are several methods of collecting urine. .The method of collection of urine decides the level of significant bacteriuria.In toilet trained chidren, clean catch of mid stream urine is essential. The genitalia should be cleaned completely before collection.In uncircumcised boys, the prepuce should be retracted before collecting the urine .If the urine is collected , without retracting the prepuce, then skin flora under the prepuce contaminates the urine sample. According to the American Academy of Pediatrics 2011 guidelines, in the 2-24 months age group , urine can be collected by catherisation or suprapubic aspiration.

Otherwise, the application of an adhesive, sealed, sterile collection bag after disinfection of the skin of the genitals can be useful only if the culture is negative or if a single uropathogen is identified.Positive culture is more common in girls and in uncircumcised boys due to skin flora contamination. If one is planning to start the antibiotic therapy right after collection of urine sample for culture , bagging the specimen is a bad option as there is high risk of contamination with mixed organisms .Suprapubic aspiration is not essential all the time.

SCREENING TESTS FOR UTI:

Since it requires minimum of 24- 48 hrs for urine culture reports to come, rapid screening tests are essential to guide the initial management.

Urine examination by dipstick and microscopy are two rapid tests .They are cost effective and are essential to detect UTI for starting an empirical therapy before the culture arrives.

1) NITRITE AND LEUKOCYTE ESTERASE TESTS USING DIPSTICK:

A) NITRITE TEST:

The Griess nitrite test involves the detection of nitrite levels in the urine .Bacterial enzymes nitrate reductase converts nitrate to nitrite . This breakdown of nitrate is seen commonly in gram negative organisms like Ecoli . A minimum incubation period of 4 hours causing urinary stasis is essential for the conversion to nitrate by the bacteria. Because of these reasons ,nitrite test has very poor sensitivity . But early morning freshly voided sample following adequate stasis showing positive nitrite test is highly specific for UTI.[40]

FALSE POSITIVE NITRITE TEST:

1) If test is done after long hours of collection of sample.

2)The reagent on the dipstick is highly sensitive to air and the box should be tightly closed after taking out the strip. In case of air exposure also , the nitrite test may be falsely positive.

FALSE NEGATIVE NITRITE TEST :

1)Gram positive organism not reducing nitrate

2)Low dietary nitrate levels

B)LEUKOCYTE ESTERASE TEST :

It is found in the azurophilic granules of neutrophils. It is an enzymatic remanant of the white blood cells. The proteins present in the azurophilic granules contain esterolytic property. The reagent on the dipstick reacts with this enzyme , giving rise to blue colour. The pus cells may not be visible on microscope, they are labile.

Since LE is only an enzymatic remanant, it can be detected on dipstick, even when there is no pyuria. It detects intact as well as lysed neutrophils. So it is more sensitive test than pyuria.

FALSE POSITIVE LEUKOCYTE ESTERASE TEST:

1) Urine contamination with skin flora or vaginal secretions

2) Other cellular source of esterase

3) Presence of oxidising agents, formalin

FALSE NEGATIVE LEUKOCYTE ESTERASE TEST:

1) High ascorbic acid level

2) Boric acid

3) Altered specific gravity, protein, sugar level

4) Antibiotics like tetracycline, cephalothin cephalexin

TABLE 1: SENSITIVITY AND SPECIFICITY OF COMPONENTS OF URINALYSIS, ALONE AND IN COMBINATION

TEST	SENSITIVITY	SPECIFICITY
Leukocyte Esterase	83(67-94)	78(64-92)
Nitrite	53(15-82)	98(90-100)
Leukocyte Esterase or Nitrite	93(90-100)	72(58-91)
Microscopy (WBCS)	73(32-100)	81(45-98)
Microscopy (Bacteria)	81(16-99)	83(11-100)
Le or nitrite or Microscopy	99.8(99-100)	70(60-92)

Figure 5 DIPSTICK STRIPS

2) Pyuria (leukocytes on light microscopy) suggests UTI. Detection of more than 5 pus cells in centrifuged urine with bacteriuria or more than 10 pus cells in uncentrifuged urine in Neubauer counting chamber or gram staining detecting bacteria is essential to brand as UTI.Infection can also be present in the absence of pyuria.False negative tests are because of cell lysis. Pyuria can be present in the absence of infection.

Sterile pyuria (presence of pus cells in urine without UTI)is seen in partially treated UTI , UTI in the presence of urinary tract obstruction, urethritis as a result of sexually transmitted disease,viral infections, Renal tuberculosis, renal abcess, inflammation near the bladder(appendicitis , crohns disease),interstitial nephritis (eosinophils).

In the study done by Kagan Huysal and collegues , he concluded that among the various parameters studied in microscopy and dipstick , detection of leucocytes is suggestive of inflammation of urinary tract .It is considered a reliable parameter for UTI than bacteriuria.

Bacteriuria is estimated using gram stain or flow cytometry. It detects both live as well as killed bacteria while culture detects only live bacteria.Hence false positivity is high with bacteiuria.

3) Hematuria is common in cystitis but microscopic hematuria is not specific for UTI

4) White blood cells casts in the urine is suggestive of renal parenchymal involvement but this is rarely detected .

If the child is symptomatic and urine analysis is normal, it can still be UTI.If the child is asymptomatic and urinalysis is normal, it is unlikely to be UTI .

5) URINE CULTURE:

Urine culture being the gold standard in the diagnosis of UTI, is useful for detecting the organism ,whether there is significant growth of organism, the susceptibility to antibiotics and helps us confirm the diagnosis and thus altering the management regarding the choice of antibiotics.

Prompt plating of the sample for culture is essential. It should be placed on the culture plate within 60 minutes of collection. Otherwise the growth of the minor organisms may mimic UTI. In case of suspected delay, the urine sample should be refrigerated without delay.

If the culture shows more than 50,000 organism of a single pathogen in suprapubic aspirate or catherised sample or if there is presence of 10,000 organisms and if the child is symptomatic, it is considered to be UTI. If there is presence of 100,000 organisms that too a single pathogen on culture if the patient is symptomatic and the urinalysis is also positive, then it is presumed to be UTI. Some authors are of the opinion that any number of organisms detected by suprapubic aspirate is suggestive of UTI [35,36,37]. If these criteria are all not met, then catherised

urine sample is recommended .Urine cultures should be drawn before starting antibiotics[5]

Some authors are of the opinion that urine culture is indicated only if urine is cloudy or leukocyte esterase or nitrite activity by dipstick analysis is positive.[41,42]

SIGNIFICANT URINE CULTURE-TABLE 2

COLLECTION METHOD	SIGNIFICANT GROWTH	SENSITIVITY
Suprapubic aspirate[35,36,37]	Any number	99%
Catherisation[38,39]	$5*10^4$	95%
Mid stream urine[38,39]	100,000	90-95%

When renal parenchymal involvement is present , then the patient may show leucocytosis with neutrophilia, elevated ESR , CRP, procalcitonin levels .But these are nonspecific markers for the acute pyelonephritis.Renal abcess may show elevated WBC count more 20,000-25,000 /cmm^3 .Elevated procalcitonin levels are associated with pyelonephritis and renal scarring.As children with pyelonephritis and obstructive uropathy are prone for sepsis , blood cultures should be drawn before starting antibiotics.

Blood cultures though not essential ,if done it is more likely to be positive in cases of Staphylococcus aureus and Group B Streptococcal infection.[43,44]

IMAGING STUDIES IN CHILDREN WITH A FEBRILE UTI:

Efficient antenatal ultrasound and follow up has substantially decreased the use of imaging workup following urinary tract infection in children in western countries.

The imaging study is essential to rule out anatomical abnormalities and renal involvement, renal function.

There are two types of approach:

1) Bottum – up –includes ultrasonogram and voiding cystourethrogram to look for upper urinary and lower urinary tract abnormalities like vesicourethral reflux, bladder bowel dysfunction, paraurethral diverticulum. Only significant renal scarring is detected by it .DMSA is useful for renal scarring. MCU is usually postponed 6 weeks for acute inflammation of bladder to subside. But some guidelines suggest that MCU can be carried out without delay as the degree of reflux has no significant difference in postponement. Radionucleotide VCUG has less radiation exposure compared to contrast VCUG but has poor delineation of anatomical structures, detection of paraurethral diverticulum, grading VUR and detecting whether the reflux is into the

ectopic ureter or the duplication of ureter .In boys, VCUG of the urethra is essential to rule out posterior urethral valve.

2) Top -down:

DMSA is carried out initially to avoid VCUG. 50% of febrile UTI have DMSA positive , 50% DMSA positive cases have renal scarring .In positive DMSA , VCUG is done as 80-90% of grade 3,4,5 reflux have DMSA positivity. If DMSA is normal , the chances of acute pyelonephritis is reduced .CT abdomen can be done to rule out acute pyelonephritis but DMSA is better than CT abdomen .Limitation of this is that DMSA may not be available in many centres as VCUG. Aloso a repeat DMSA should be planned after 4-6 mon in case of renal scarring.

The AAP recommends that in the first febrile UTI , USG is a must and if the USG is abnormal or in case of recurrent UTI , VCUG is recommended .In case of lower UTI , first episode does not need imaging but bladder bowel function should be assessed .In recurrence , USG with VCUG planned .

TABLE 3 - GUIDELINE RECOMMENDATIONS FOR DIAGNOSTIC EVALUATION FOLLOWING A FEBRILE URINARY TRACT INFECTION IN INFANTS

GUIDE LINE	ULTRASONOGRAPHY	VCUG	LATE DMSA SCAN
American Academy of Pediatrics	Yes	If abnormal ultrasonogram	No
Italian Society for Paediatric Nephrology (ISPN	Yes	If abnormal ultrasonogram or if risk factors are present	If abnormal ultrasonogram or VUR

TABLE 4 - RECOMMENDED IMAGING SCHEDULE FOR CHILDREN WITH URINARY TRACT INFECTION NICE GUIDELINES

TYPE OF INFECTION			
Child Age and Tests	**Responds well to Treatment within 48 hr**	**Atypical infection**	**Recurrent infection**
Ultrasound scan during acute infection	NO	YES	YES
Ultrasound scan within 6 wk of infection	YES	NO	NO
DMSA scan 4-6 mo after acute infection	NO	YES	YES

Micturating cystogram	CONSIDER IF USG N	YES	YES
CHILDREN 6 MO-3 YR OLD			
Ultrasound scan during acute infection	NO	YES	NO
Ultrasound scan within 6 wk of infection	NO	NO	YES
DMSA scan 4-6 mo after acute infection	NO	YES	YES
Micturating cystograms	NO	Not routine, consider if dilation on ultrasound, poor Urine flow,	Non–*e. Coli* infection, or family history Of vesicoureteric reflux
CHILDREN OLDER THAN AGE 3 YR			
Ultrasound scan during acute infection	NO	YES	NO
Ultrasound scan within 6 wk of infection	NO	NO	YES
DMSA scan 4-6 mo after acute infection	NO	YES	YES
Micturating cystograms	NO	NO	NO

TREATMENT OF UTI:

General measures:

1) Adequate fluid intake- Children must be advised to take plenty of fluids in frequent small aliquoits

2) Frequent voiding

3) Constipation -To be treated [45]

4) Double voiding allows adequate emptying of bladder of post void residual urine. “Drink plenty and don’t hold on” was the slogan propagated by NICE.[22]

5) Circumcision – found to reduce the risk of recurrent urinary tract infection in boys[46,47]

6) Worm infestation should be treated if present .

Acute cystitis should be treated promptly to avoid possible sequelae of pyelonephritis. If the symptoms are severe, empirical treatment is started while awaiting the results of the culture. Whereas if the symptoms are mild or the diagnosis is doubtful, treatment can be delayed till the culture results arrive .The culture can be repeated in case the results are uncertain. If treatment is to be initiated before the culture reports arrive, 3- 5-day course of trimethoprim-sulfamethoxazole (TMP-SMX) or trimethoprim is started .It is effective against many strains of E. coli. Nitrofurantoin is also effective .It is active against Klebsiella and Enterobacter organisms.

In suspected **clinical pyelonephritis,** 7-14 day course of broad-spectrum antibiotics started. Indications of IV antibiotics and IV fluids are 1 mo of age or younger, in whom urosepsis is suspected, are unable to drink fluids, with vomiting, severely dehydrated.

Indian Academy of Paediatrics recommends that the antibiotic therapy in case of complicated UTI should be for ten to fourteen days and that of simple urinary tract infection should be seven to ten days .[45-49]

In a study done in children older than two years with UTI , longer course of oral antibiotics have not found to be efficacious , hence short courses of three to five days is preferred. [50]

In a randomised control trial [51,52], on comparing oral and parenteral regimens in children with febrile urinary tract infection ,no difference has been found.

In one another study[53,54,55] done on treatment regimens of UTI short courses of three to five days have been found to be as effective as longer courses of seven to fourteen days but it is yet to be clearly proved.

IV antibiotics preferred are ceftriaxone-50-75 mg/kg/24 hr or cefotaxime-100 mg/kg/24 hr, ampicillin -100 mg/kg/24 hr with an aminoglycoside such as gentamicin 3-5 mg/kg/24 hr in 1-3 divided doses.

Aminoglycosides is effective against *Pseudomonas* and use of sodium bicarbonate increases its effectiveness by alkalisation of urine in the urinary tract.

According to another study [56,57],once daily administration of gentamycin or ceftrioxone intravenously in a day care treatment setting was found to safe , effective and cost effective in children with UTI .

In out patient department, oral third-generation cephalosporins - cefixime are also effective against a variety of Gram-negative organisms except *Pseudomonas*. Nitrofurantoin does not achieve significant renal tissue levels and not used routinely in febrile UTI.

A urine culture done 1 wk after the completion of treatment of a UTI shows sterile urine. But a routine repitition of culture is not essential. In case, there is no response to antibiotics in 72 hrs , then culture can be repeated[58].

Renal or perirenal abscess need surgical or percutaneous drainage unless it is small which can be treated conservatively.

Role of urinary probiotic that promotes urinary tract flora and cranberry juice that prevents bacterial adhesion and biofilm formation is still unclear.

PROPHYLAXIS

Following are the indications for prophylactic drugs in urinary tract infection are

- children < 1year while awaiting imaging studies following an episode of urinary tract infection
- children with neuropathic bladder, urinary tract stasis and obstruction, severe vesicoureteral reflux and urinary calculi
- children with frequent febrile UTI -three or more episodes in an year

In case of grade I and II vesico ureteric reflux prophylaxis is given up to one year and restarted if febrile urinary tract infection occurs. In grade III to IV vesico ureteric reflux prophylaxis is given till five years of age and surgery is done if breakthrough febrile urinary infection occurs.

Beyond five years, prophylaxis is continued only if bowel bladder Dysfunction occurs.

Prophylactic drug must be effective, non toxic with fewer side effects and should not affect the growth of commensals or induce bacterial resistance.

Preferred antibiotics are

a. Cotrimoxazole 1-2 mg/kg/day (not in <3 months, G6PD deficiency)

b. Cephelexin 10mg/kg/day (preferred in 3-6months babies)

AIM AND OBJECTIVES OF THE STUDY

AIMS AND OBJECTIVES OF THE STUDY

The aim of this study was to detect the utility of urine dipstick in screening UTI in children.

The objective was to determine the performance characteristics of urine nitrite and leukocyte esterase test compared with urine culture, which was set as the gold standard in diagnosing UTI.

MATERIALS AND METHODS

MATERIALS AND METHODS

SETTING

The study was conducted at the Department of Pediatrics, ICHRC, Madurai medical college. The study population included 262 Patients with suspected UTI attending OPD or getting admitted in our hospital.

STUDY DESIGN

It was a hospital based prospective study for evaluation of screening test conducted in the year (Oct 2016-Oct 2017)

INCLUSION CRITERIA:

1) CHILDREN AGE 2 -12 YRS OF AGE WITH

Symptoms suggestive of UTI or

Febrile Children with undetectable focus

EXCLUSION CRITERIA

Children < 2 yr (excluded because of decreased chances of urinary retention for four hours which is a requirement for nitrite test, difficulty in urine collection in children who are not yet toilet trained)

METHOD OF COLLECTION OF DATA

Following an informed parental consent, clinical history was taken, examination was done, comorbidities were noted, and the panel of investigations were collected from all eligible children. Basic investigations like complete blood count, urinanalysis were done .Renal function tests were carried out for all children .USG Abdomen and pelvis

was done in all chidren .As per IAP guidelines, Micturiting Cystourethrogram was done for eligible children.

COLLECTION OF SAMPLE:

Under strict aseptic precautions, urine samples. were obtained for both, urine analysis and urine culture in 2 different containers. The methods of urine collection practised in our study were mid stream clean catch sample or catherised or bag method. Contamination by periurethral and prepucial organisms was minimized by washing the genitalia with soap and water. Antiseptic washes and forced prepucial retraction were not advised.

The samples collected for urine analysis and urine culture were sent to clinical pathology lab and microbiology lab respectively within 2 hours of collection The specimen was directly collected in a sterile glass or plastic bottle. A urine culture was repeated in case contamination was suspected, *for eg*, mixed growth of two or more pathogens, or growth of organisms that normally constitute the periurethral flora (lactobacilli in healthy girls and enterococii in toddlers). The culture was also repeated in situations where UTI was strongly suspected but colony counts were equivocal.

The initiation of empirical treatment was decided by the treating physician.

Urine analysis was performed and was cross verified by a trained lab technician and urine culture was done by a lab technician, under supervision of microbiologist.

For the microscopic analysis, the urine sample was placed in a labeled plastic conical tube. This conical tube was then covered with a tight fitting cover. The tube was placed in the centrifuge along with a second tube filled with water in equal amounts which will act as the counter weight. Urine specimen was then centrifuged at relative centrifugal force of 400xg for 5- 1 0mm. After centrifuge had stopped, the tube was removed and the supernatant was poured off , leaving sediment in the bottom of the tube. With a plastic pipette ,the remaining sediment was mixed. If no sediments were visible, then a few drops of the mixture were taken from bottom of the tube. A drop of the sediment solution plsced was over a glass slide and a cover slip was placed over it. The sediment was examined using light microscope under low lOX power and 40X power, scanning several fields to obtain an estimate on the rage number of elements.

The principle of urine microscopy is identifying and quantifying bacteria, cells and other materials in a sediment of centrifuged sample. It detects RBCs, WBCs, Hyaline, cellular, Epithelial cells, granular fatty casts. Microscopic hematuria, wbcs and bacteria are detected under direct microscopy.

Pyuria –Presence of more than 10 pus cells in uncentrifuged urine or more than 5 in centrifuged urine is considered significant.

Hematuria –Presence of >5 RBCS/high power field present is considered significant

Urine dipstick test- dipstick was dipped in urine for 60 sec to detect the presence of nitrite in urine .Nitrite was considered as positive if there was a change in colour of dipstick from colourless towards pink within 60 seconds. Depending on intensity of colour change, the results were graded as 0 , 1+ ,2+ ,3+,4 + .Except for no change in colour ,others were considered positive. Leukocyte esterase was considered as positive if there was a change in colour from white towards purple within 2minutes. Depending on intensity of colour change ,the results were graded as 0 , 1+ ,2+ ,3+,4+ .Except for no change in colour ,others were considered positive .

Urine culture was done to detect the organism responsible for causing urinary tract infection. Because of the high risk of contamination in conventional method of urine collection, a quantitative cut off or significant colony forming units were fixed to help differentiate between contamination , infection or colonization.

Significant bacteriuria:

Colony count of > 10^5 of a single pathogens or in patients with Urethral catheterisation > I 0 ^{4}CFU/ml is considered significant

bacteriuria. Low counts is considered significant if patient is symptomatic.

The results obtained from both urine dipstick and microscopy were compared with urine culture. 4 parameters such as leukocyte esterase, pyuria, nitrites, and hematuria were compared with urine culture

STATISTICAL ANALYSIS:

Data was entered into Microsoft excel and results were analysed using SPSS software . Continuous data were reported as mean ± SD (if normally distributed) ,as median (range) (if non-normally distributed). Results on categorical measurements were presented in Number and percentages. Sensitivity, specificity, negative and positive predictive values for leucocyte esterase, pyuria, nitrites and combined nitrite and leucocyte esterase were analyzed by comparing the test results with the gold standard norms (culture proven UTI cases and sterile culture cases).

This was done by identifying the true negative, true positive, false positive and false negative values for each variable and substituting it by the standard formula. Each parameter is compared in both the groups to see if these parameters are significantly higher in the culture proven UTI group , as compared to the sterile culture group. Further combination of parameters are compared to find out the maximum sensitivity and

specificity . After calculating the sensitivity and specificity , likelihood ratio was also calculated .Likelihood ratio > 1 means test is effective and < 1 means that the test is not effective . Chi-square test have been used to find the significance of study parameters on categorical scale between two groups. P value: < 0.05 have been considered statistically significant. Graphical illustrations have been done.

RESULTS

RESULTS

TABLE 5-PROFILE OF STUDY POPULATION

AGE	No Of Cases	Percentage
3- 5 YRS	93	35.5
6-10 YRS	150	57.3
>10	19	7.3
Total	262	100.0

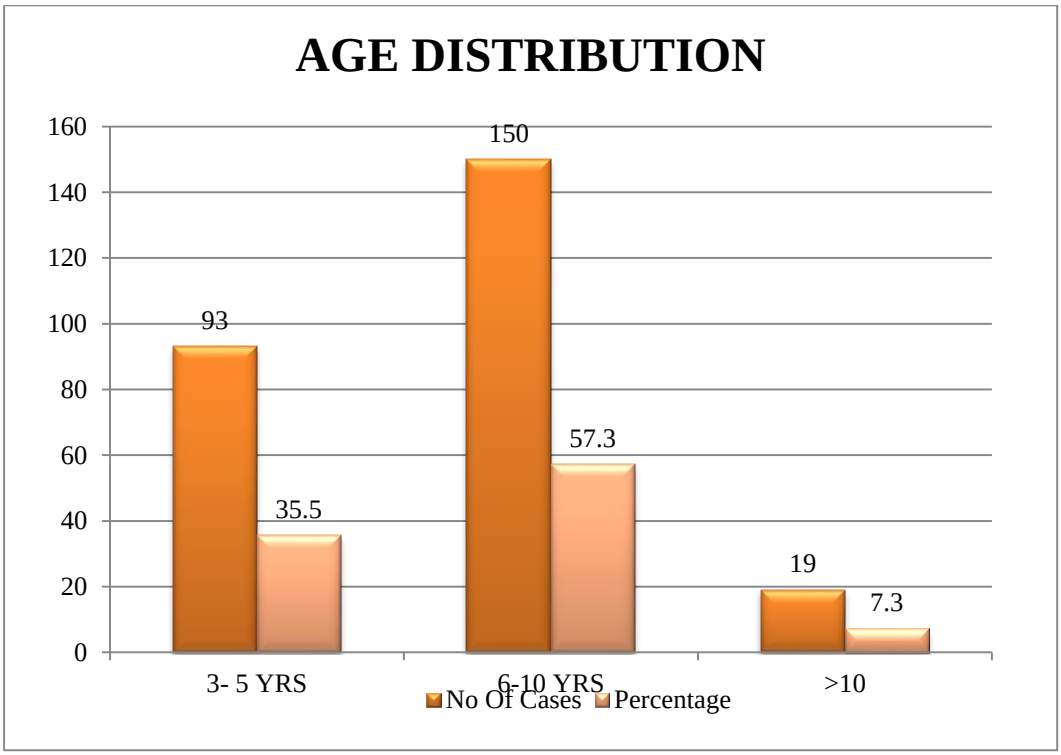

Figure 6 AGE DISTRIBUTION OF STUDY POPULATION

Of the total 262 cases , 112 became culture positive , but 10 had scanty growth in culture ,so it was not considered significant .So, hereafter ,we will discuss only 102 cases as culture positive .

Out of the 262 cases ,93 cases (35.5%) were in the age group 3-5years,150 cases with 6-10 years (57.3%),19 cases above 10 years of age (7.3%). Median age of distribution was 6years with a SD of +/- 2.36 .Out of the 262, 102 were culture positive. Among the culture positive group,3-5 years were 35(34.3%), in 6- 10 yrs were 62(60.78%)and >10 years were 19 (18.62%).There was no statistical significance between different age groups for culture positive and culture negative individuals.(p value 0.365) .

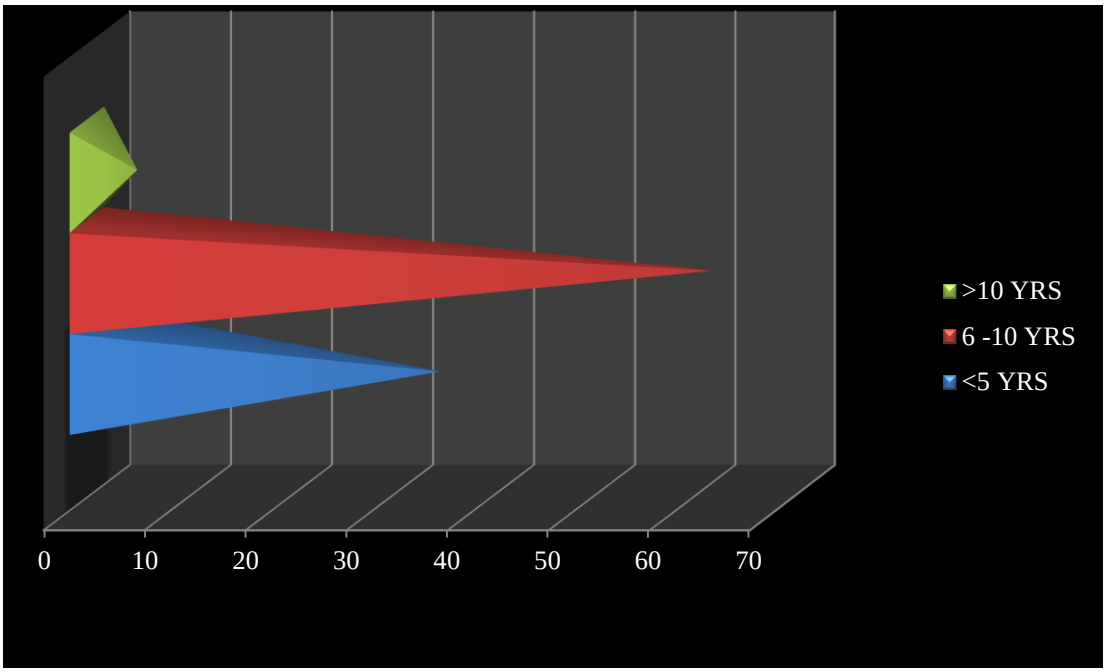

Figure 7 AGE WISE DISTRIBUTION OF CULTURE POSITIVE CASES

SEX DISTRIBUTTION OF STUDY POPULATION:

Among the 262 study population, 123(46.9%) were male children and 139(53.1%) were female children

TABLE 6-SEX DISTRIBUTTION OF STUDY POPULATION

SEX	Frequency	Percentage
Male	123	46.9
Female	139	53.1
Total	262	100.0

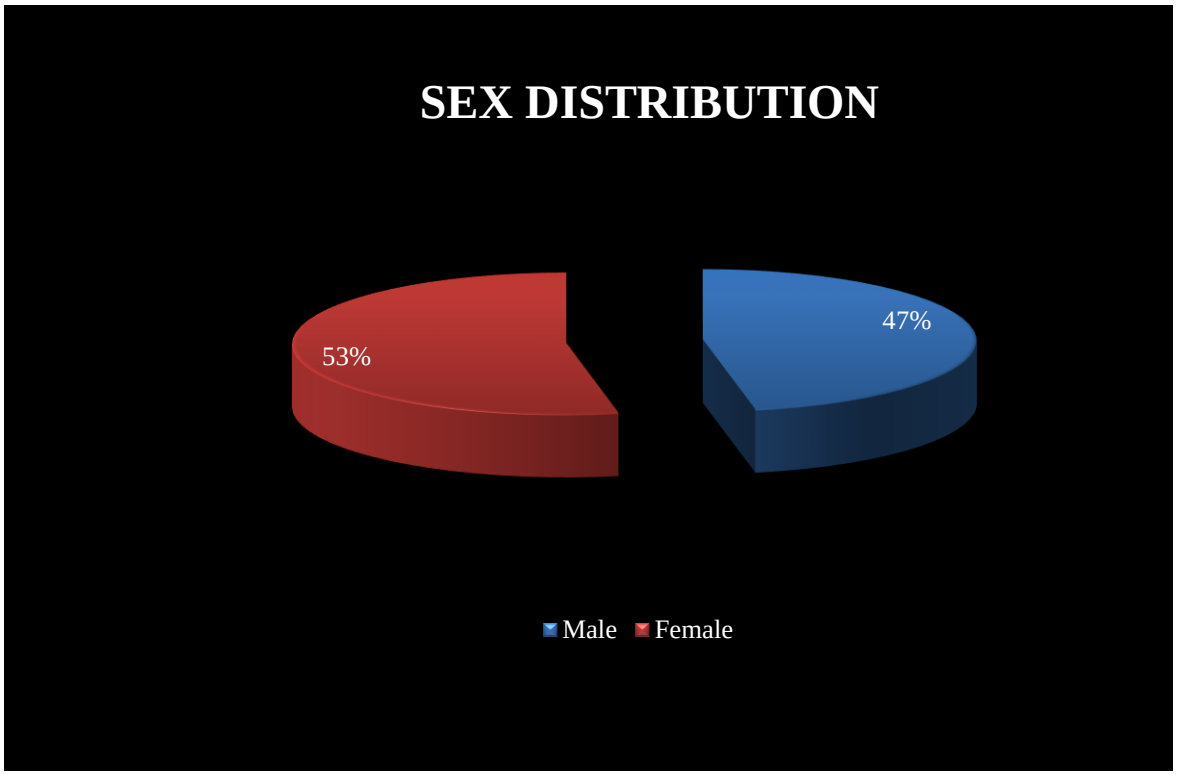

Figure 8 SEX DISTRIBUTION OF STUDY POPULATION

Among the study population, in males, 49 (48.03%) were culture positive, among the female children ,53 (51.96%) were culture positive .

SYMPTOMATOLOGY:

Most common symptom was dysuria in 240cases (91.6%) followed by increased frequency of micturition(229) 87.4%, persistent vomiting (174) 66.4% , abdominal pain(150) 57.3% fever (122) 46.6% , hematuria (44) 16.8%, pyuria (32) 12.2%, followed by constipation (30) 11.5%.

Fever as a symptom was present in 122 patients(46.6%).Out of this ,fever of < one week was present in 89 children (34%), 1 week fever was present in 29 children (11%), more than one week fever was present was present in 2 children(0.8%).

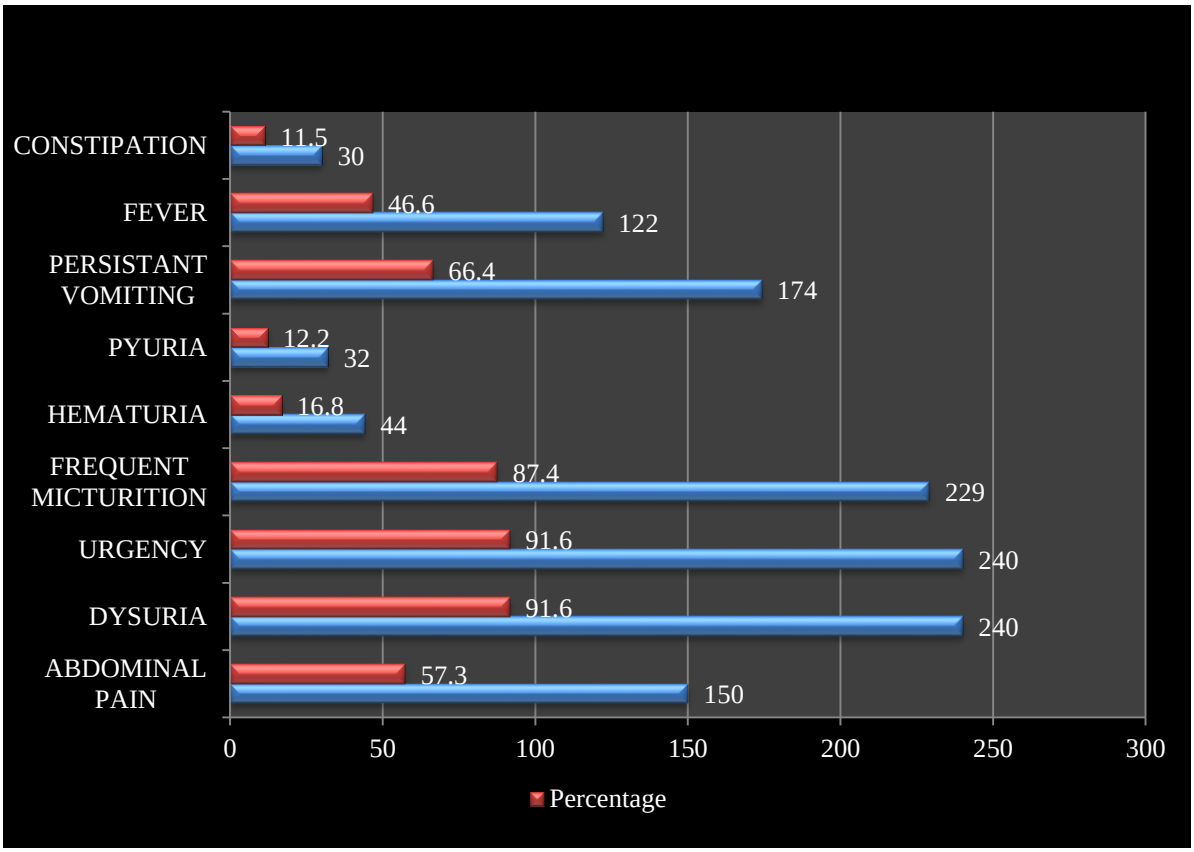

Figure 9 SYMPTOMATOLOGY

EXAMINATION:

On general examination , pallor was observed in 10 children (3.8%), facial puffiness in 10 children (3.8%).Pedal oedema was present in 5 children (1.9%).

High grade temperature was recorded in 114 children (43.5%) and temperature was normal in 148 children (56.5%). All the 262 children examined had a normal blood pressure.

Abdominal examination was normal in 111 children (42.4%), suprapubic tenderness was present in 146 children (55%).Lumbar tenderness was present in 4 children (1.5%), periumblical tenderness was present in 1 child (0.4%).

On routine genitourinary examination in male children,29(11.1%) had phimosis Vulval synechia was not observed in any female children

Among the 262 cases, 12 children had associated comorbidities.4 had nephrotic syndrome , 3 had neurogenic bladder, 2 had posterior urethral valve and 1 had vesicourethral reflux, 1 had hydroureteronephrosis, 1 had PUJ obstruction.

History of previous urinary tract abnormalities was present in 6 children (2.3%).

TABLE 7 - COMORBIDITIES ASSOCIATED WITH STUDY POPULATION

ASSOCIATED COMORBIDITY	No Of Cases	Percentage
No comorbidity	250	95.4
Nephrotic syndrome	4	1.5
Neurogenic bladder	3	1.1
Posterior urethral valve	2	0.8
Primary vesicourethral reflux	1	0.4
Hydroureteronephrosis	1	0.4
PUJ obstruction	1	0.4
Total	262	100.0

URINE MICROSCOPIC ANALYSIS:

Urine microscopy for pus cells showed that, in 165 (63%)cases , no pus cells were observed. In 54 cases (20.6%), upto 5 pus cells were noted , in 37 cases (14.1%) 5-10 pus cells,and in 6 cases (2.3%) , more than 10 pus cells were noted .

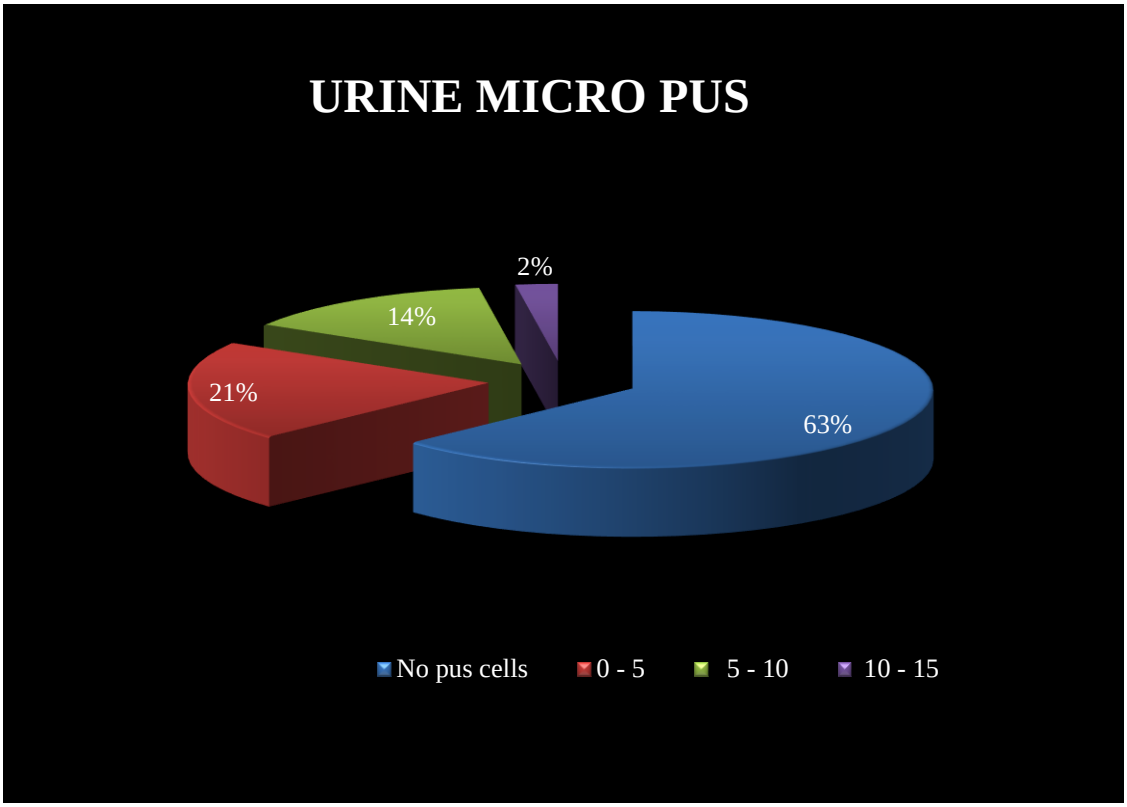

Figure 10 URINE MICROSCOPY

PUS VS CULTURE	Culture +	Culture -	
Pyuria +	66	31	97
Pyuria -	36	129	165
Total	102	160	262

Sensitivity , specificity , positive and negative predictive value of pyuria compared to urine culture were upto 64.7%, 80.6%, 68% and 78.1% respectively. The p value detected by chi square test was stastistically significant <0.001.

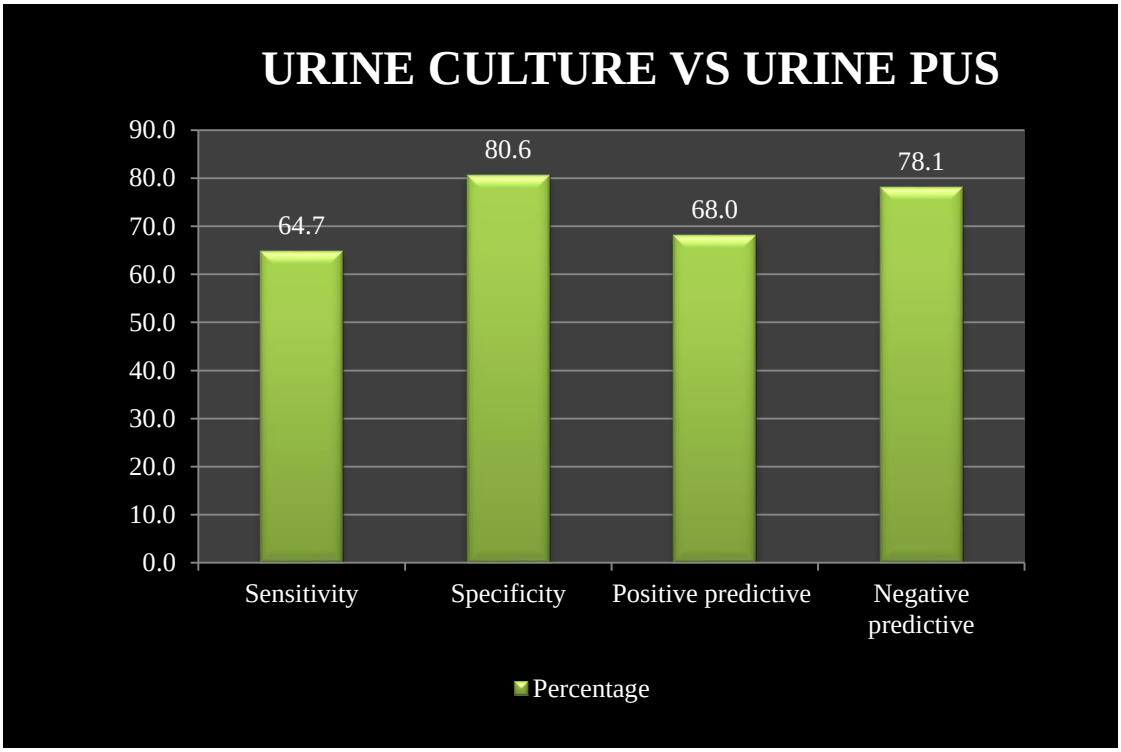

Figure 11 SENSITIVITY, SPECIFICITY, PPV ,NPV OF PYURIA

Among the culture positive group(102), pyuria was present in 66 children and negative in 36 children.

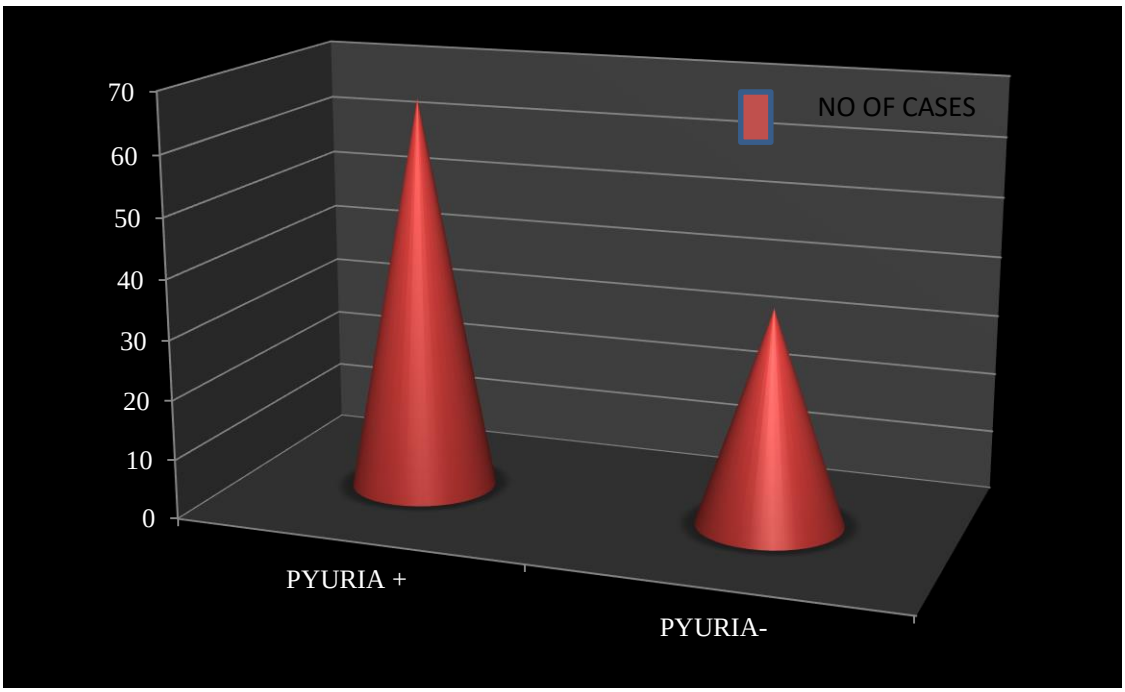

Figure 12 PYURIA IN CULTURE POSITIVE CASES

Among the culture negative group, pyuria was positive in 31 , was negative in 129.

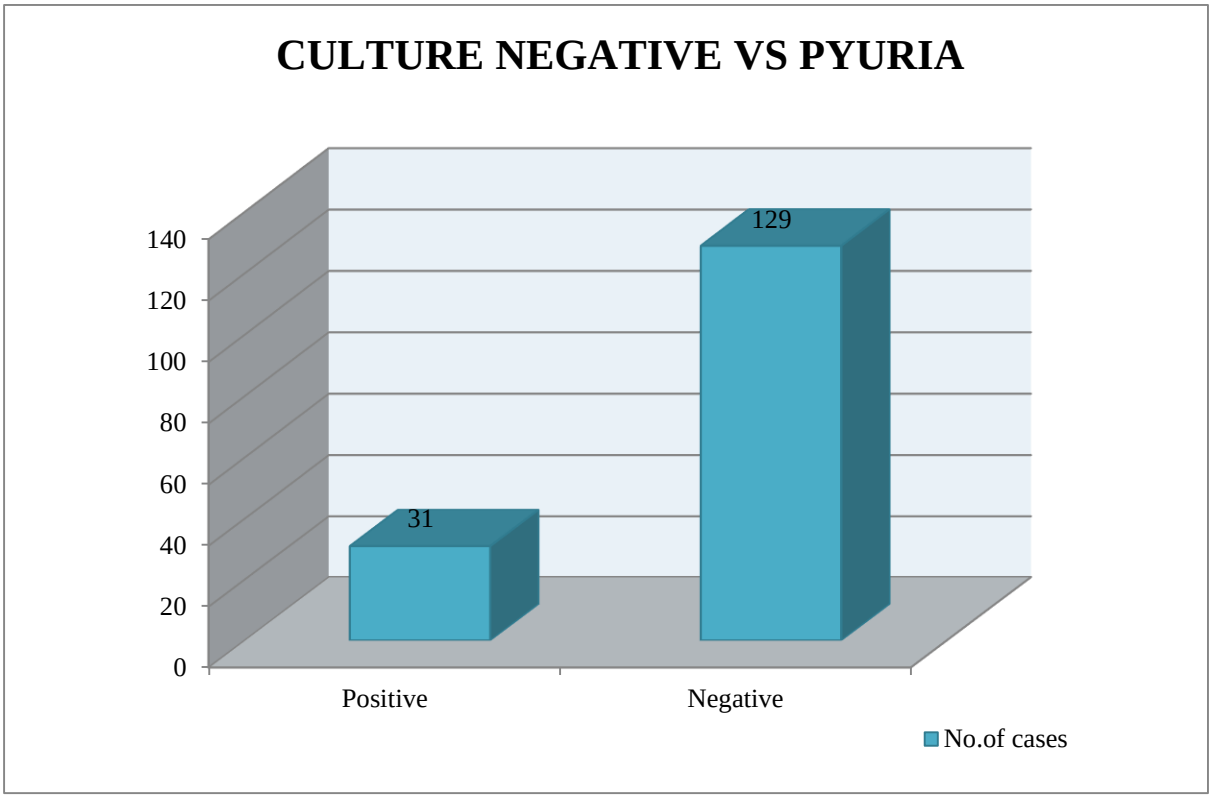

Figure 13 PYURIA IN CULTURE NEGATIVE CASES

The P value calculated by chi square test was <0.001, was statistically significant. Likelihood ratio was calculated, positive LR was 3.335.Negative likelihood ratio was 0.437.

LEUKOCYTE ESTERASE:

Among the 262 cases, Leukocyte esterase was negative in 136 cases(51.9%), positive in 126 cases .Out of this 126 cases, in 23(51.9%)cases - 1+ colour change was noted ,in 68 cases (26%)- 2+

colour change was noted, in 31 cases (11.8%) 3+ colour change was noted ,in 4(1.5%) cases 4+ colour change was noted.

	Culture +	Culture -	
LE +	92	34	126
LE -	10	126	136
Total	102	160	262

Sensitivity, specificity, positive predictive value, negative predictive value of Leukocyte esterase compared to urine culture were upto 90.1% ,78.7% ,73% ,92.6% respectively. P value is statistically significant <0.001.

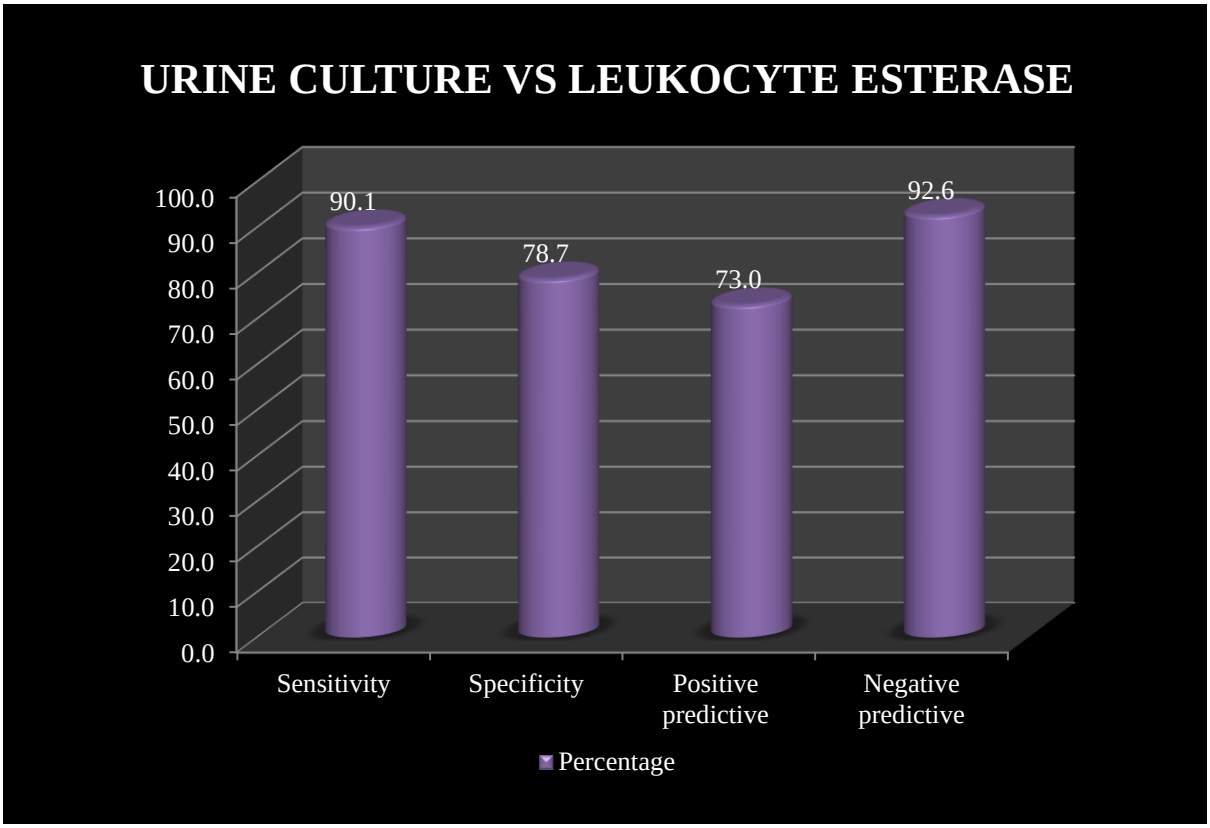

Figure 14 SENSITIVITY, SPECIFICITY, PPV, NPV OF LEUKOCYTE ESTERASE

Among the culture positive cases 102, Leukocyte esterase was positive in 92, negative in 10.

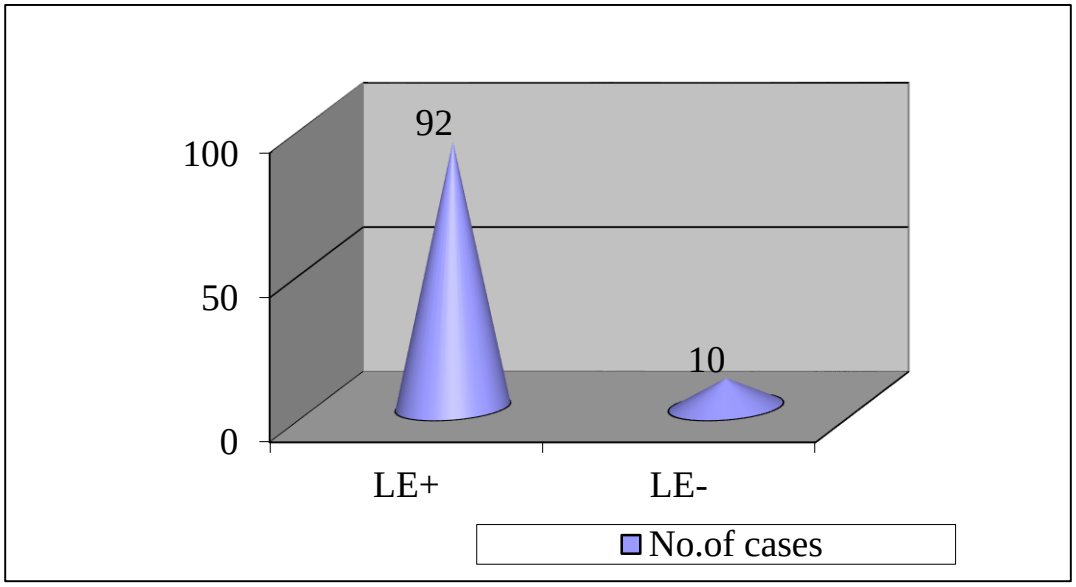

Figure 15 LEUKOCYTE ESTERASE IN CULTURE POSITIVE CASES

Among the culture negative cases, leukocyte esterase was positive in 31 cases and negative in 126 cases.

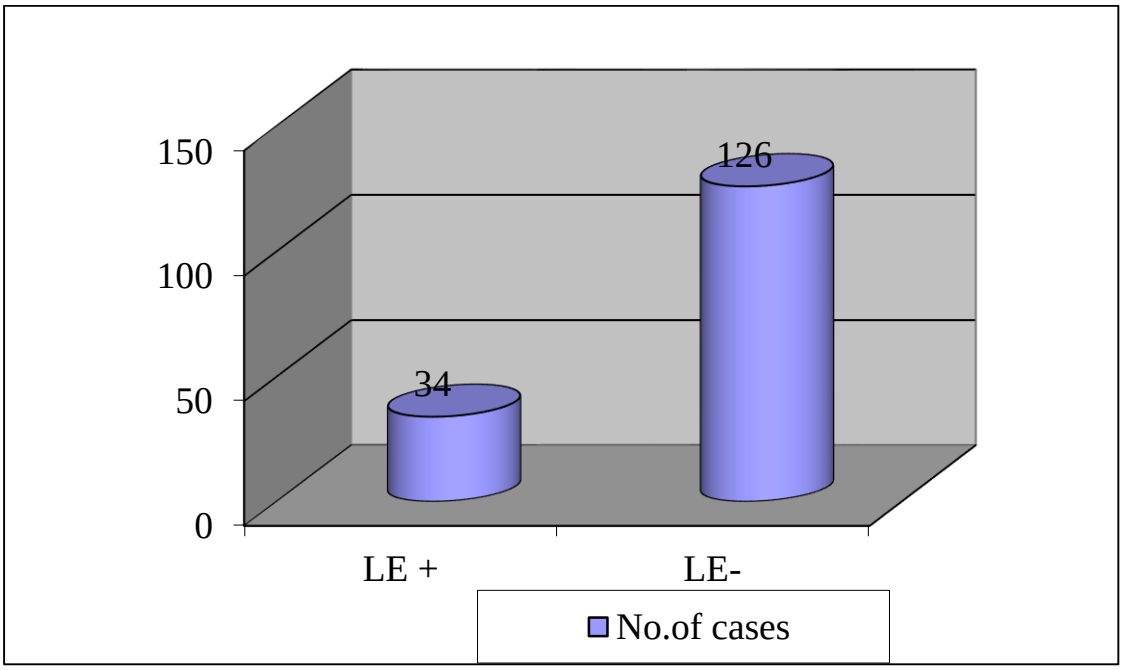

Figure 16 LEUKOCYTE ESTERASE IN CULTURE NEGATIVE CASES

The p value calculated by chi square test was <0.001 and was stastistically significant. Positive likelihood ratio was 4.23 and negative likelihood ratio was 0.1257.

NITRITE TEST:

Among the 262 cases , nitrite was negative in 163(62.2%), positive in 99 cases .Out of this 99 cases ,in 29(11.1 %)cases - 1+ colour change was noted ,in 44 cases (16.8%)- 2+ colour change was noted ,in 20 cases (7.6 %) 3+ colour change was noted ,in 6(2.3%) cases 4+ colour change was noted.

	Culture +	**Culture -**	
NITRITE +	87	12	99
NITRITE -	15	148	163
Total	102	160	262

All the true positive cases had gram negative organisms in culture.

Sensitivity, specificity, positive predictive value, negative predictive value of nitrite compared with urine culture were upto 92.5%, 92.5%, 87.9%, 90.8% .

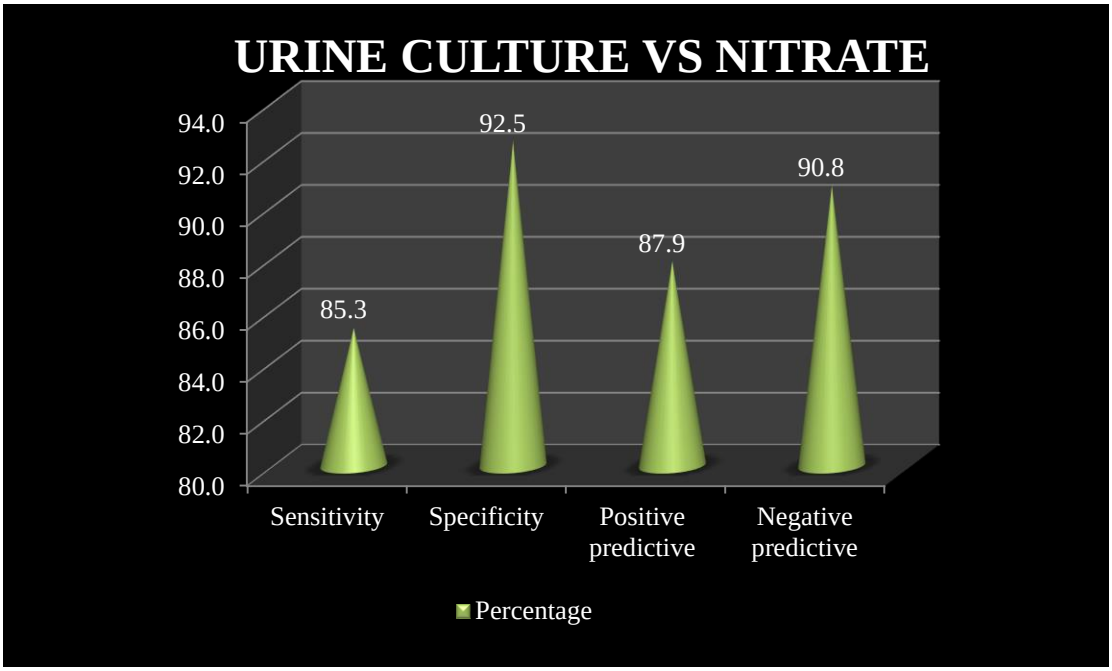

Figure 17 SENSITIVITY, SPECIFICITY, PPV, NPV OF NITRITE TEST

Among the culture positive cases 102, nitrite test was positive in 87 cases ,negative in 15 cases.

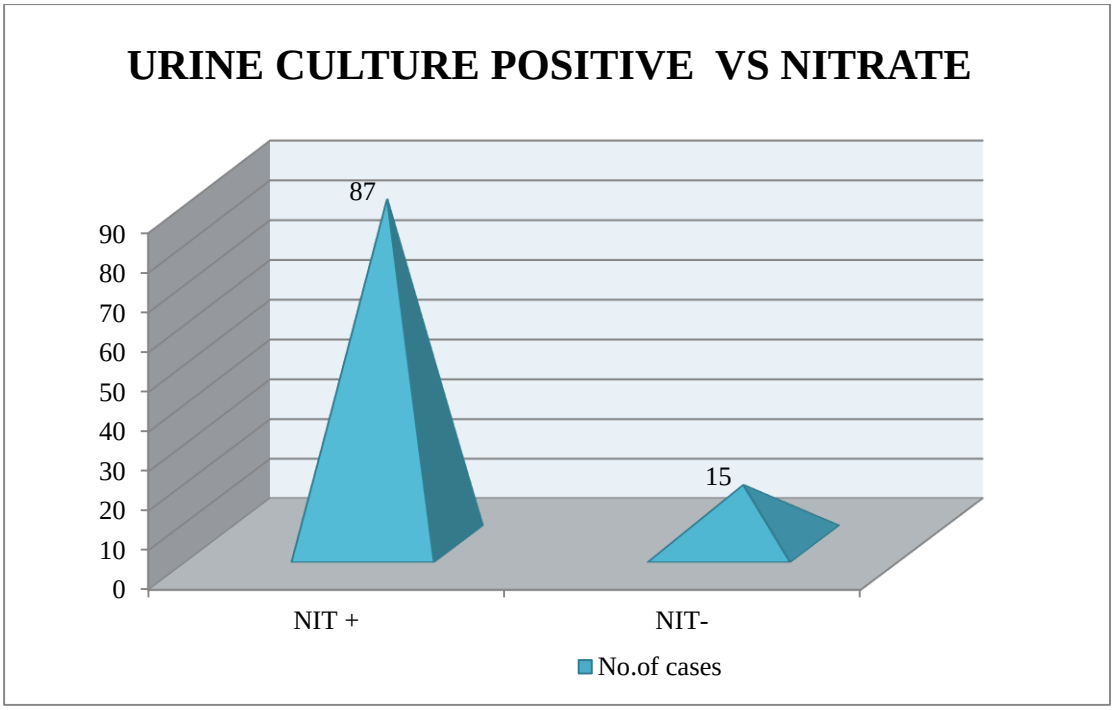

Figure 18 NITRITE TEST IN CULTURE POSITIVE CASES

Among the culture negative cases (160),nitrite test was positive in 12, negative in 148 cases.

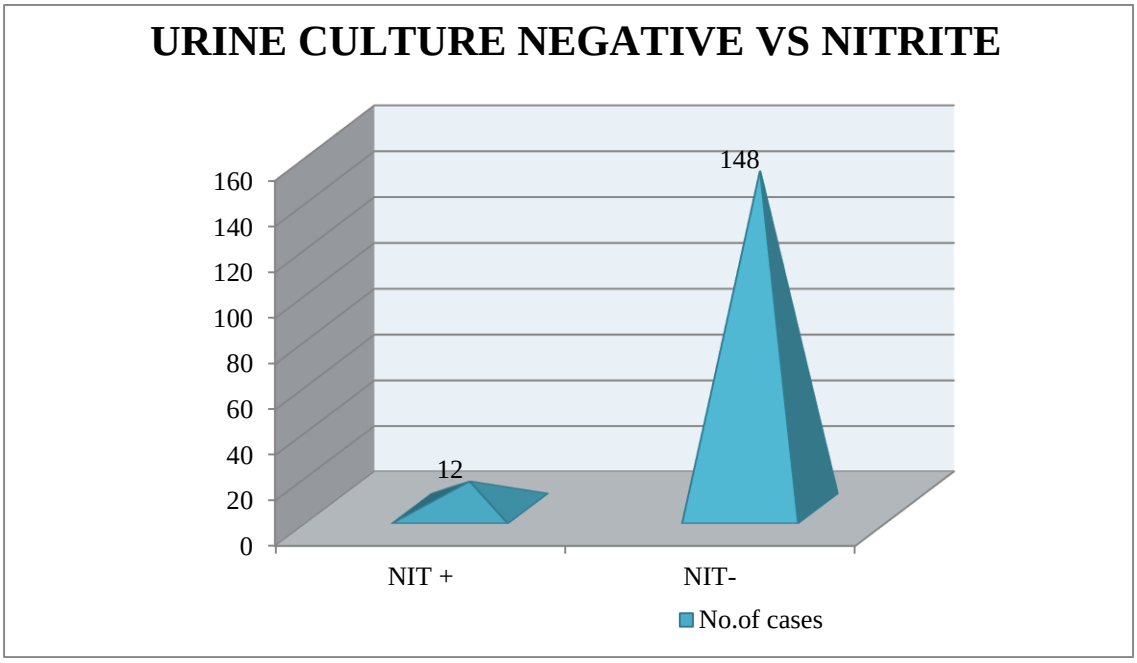

Figure 19 NITRITE TEST IN CULTURE NEGATIVE CASES

The p value calculated by chi square test was <0.001 and was statistically significant .The positive likelihood ratio was 12 and negative LR ratio was 0.107.

COMBINED NITRITE / LEUKOCYTE ESTERASE:

Among the 262 cases, combined dipstick was positive in 129(49.2%) cases and negative in 133(50.8%) cases.

	Culture +	**Culture -**	
DIP +	98	31	129
DIP -	4	129	133
Total	102	160	262

Sensitivity, specificity, positive predictive value and negative predictive value of combined dipstick compared with urine culture were upto 96%, 80.6%, 75.9% and 96.9% respectively .

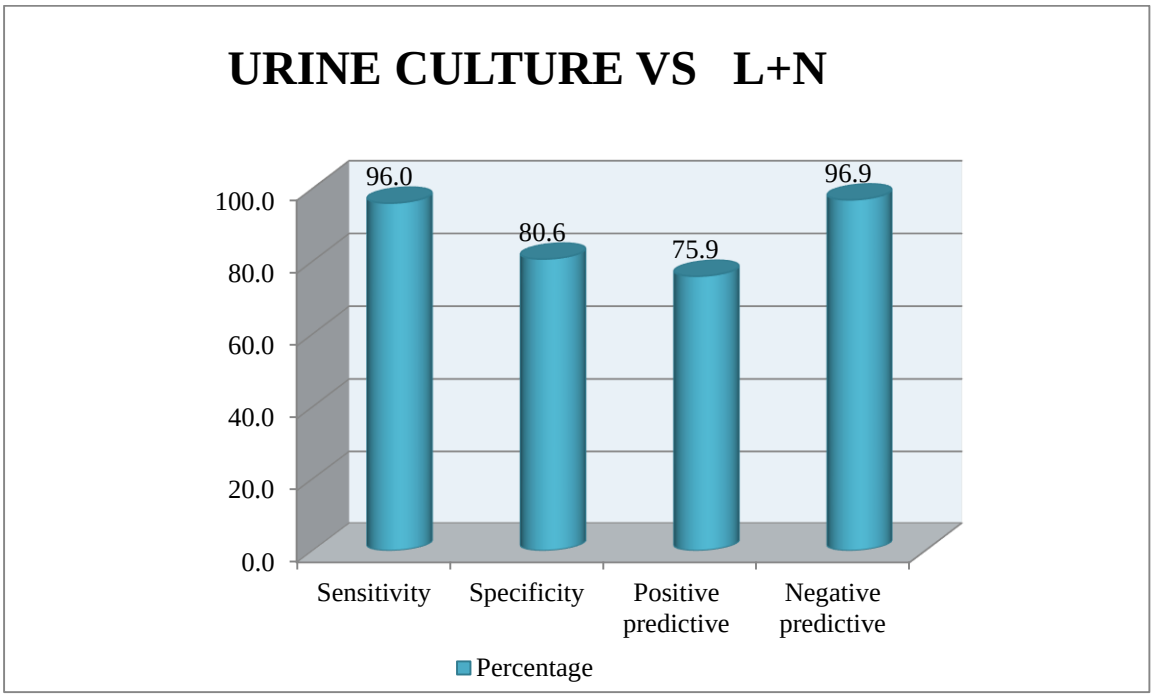

Figure 20 SENSITIVITY, SPECIFICITY, PPV, NPV OF COMBINED DIPSTICK

Among the culture positive group (102), combined dipstick was positive in 98 cases, negative in 4 cases.

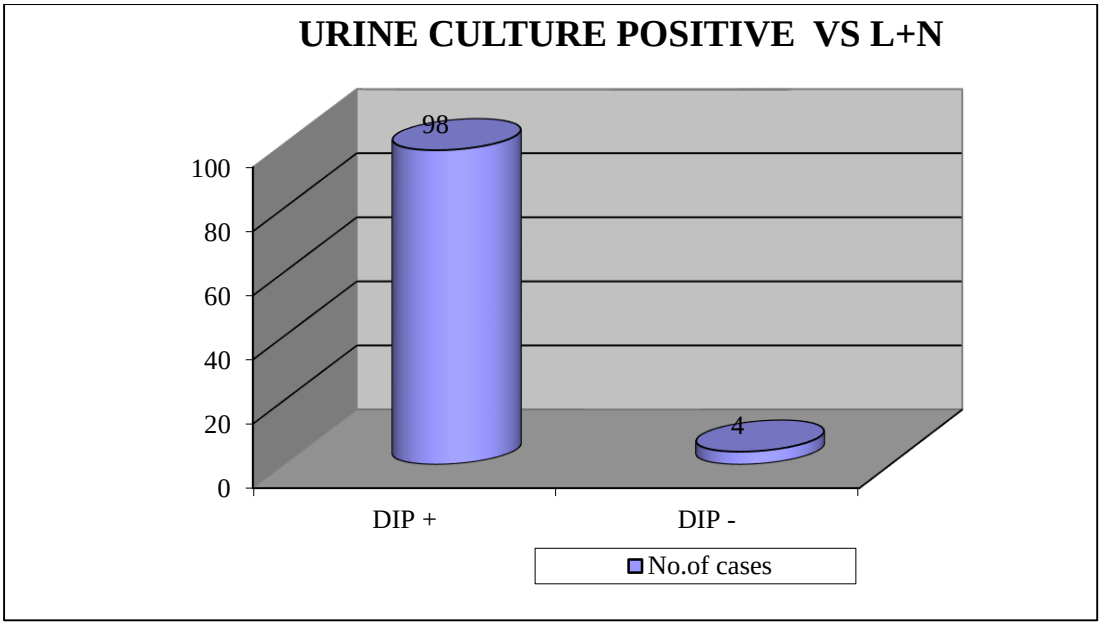

Figure 21 COMBINED DIPSTICK IN CULTURE POSITIVE CASES

Among the culture negative cases (160), combined dipstick was positive in 31 and negative in 129 cases.

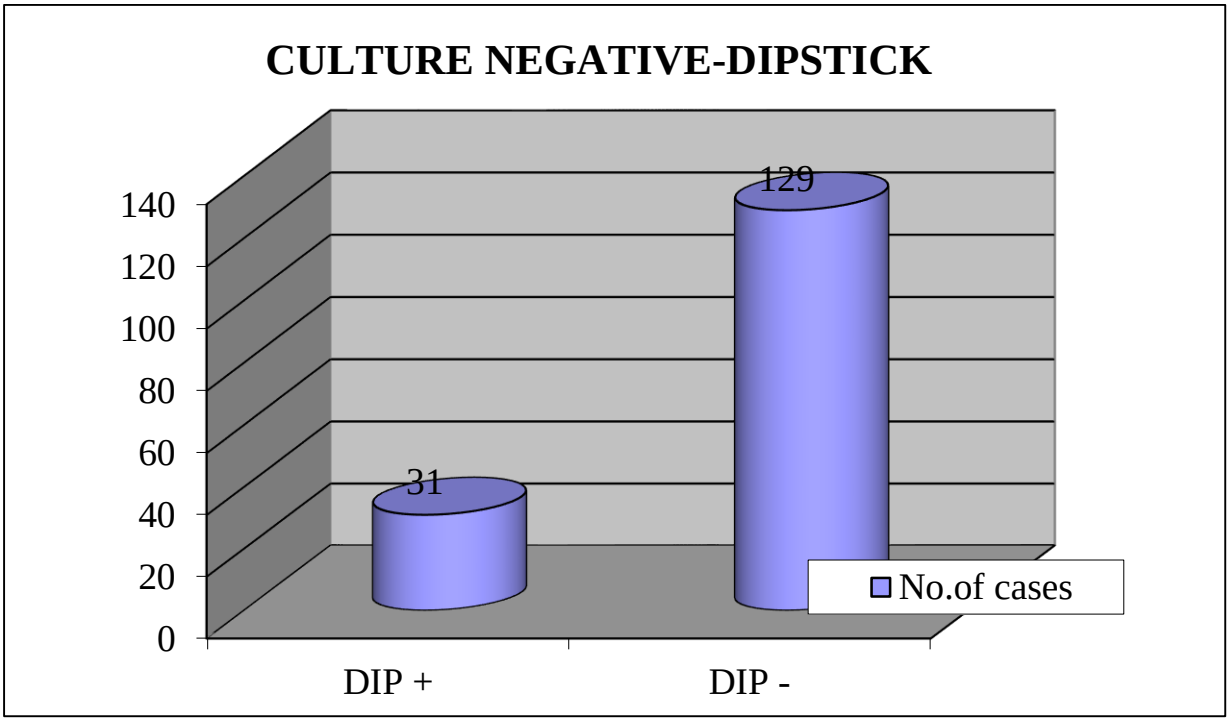

Figure 22 COMBINED DIPSTICK IN CULTURE NEGATIVE CASES

The p value obtained by chi square test was <0.001 and was statistically significant. The positive likelihood ratio was 4.94 and negative likelihood ratio was 0.004.

URINE CULTURE :

Urine culture was positive in (102)39% of cases and negative in(160) 61% of cases . All the organisms were gram negative in nature.

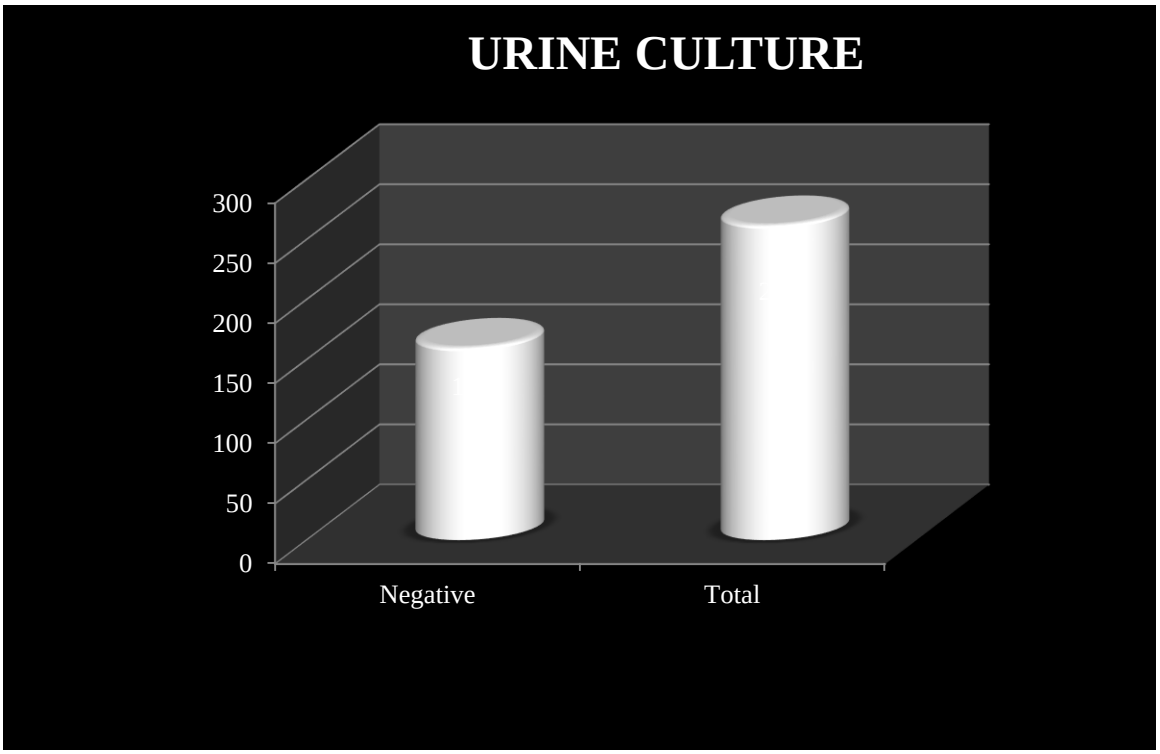

Figure 23 CULTURE POSITIVE VS CULTURE NEGATIVE

TABLE 8-DISTRIBUTION OF ORGANISMS IN URINE CULTURE

URINE CULTURE	No Of Cases	Percentage
No growth	150	57.3
Ecoli	63	24.0
Klebsiella	25	9.5
Proteus	16	6.1
Citrobacter	2	0.8
Non fermentative gram neg bacilli	5	1.9
Pseudomonas	1	0.4
Total	262	100.0

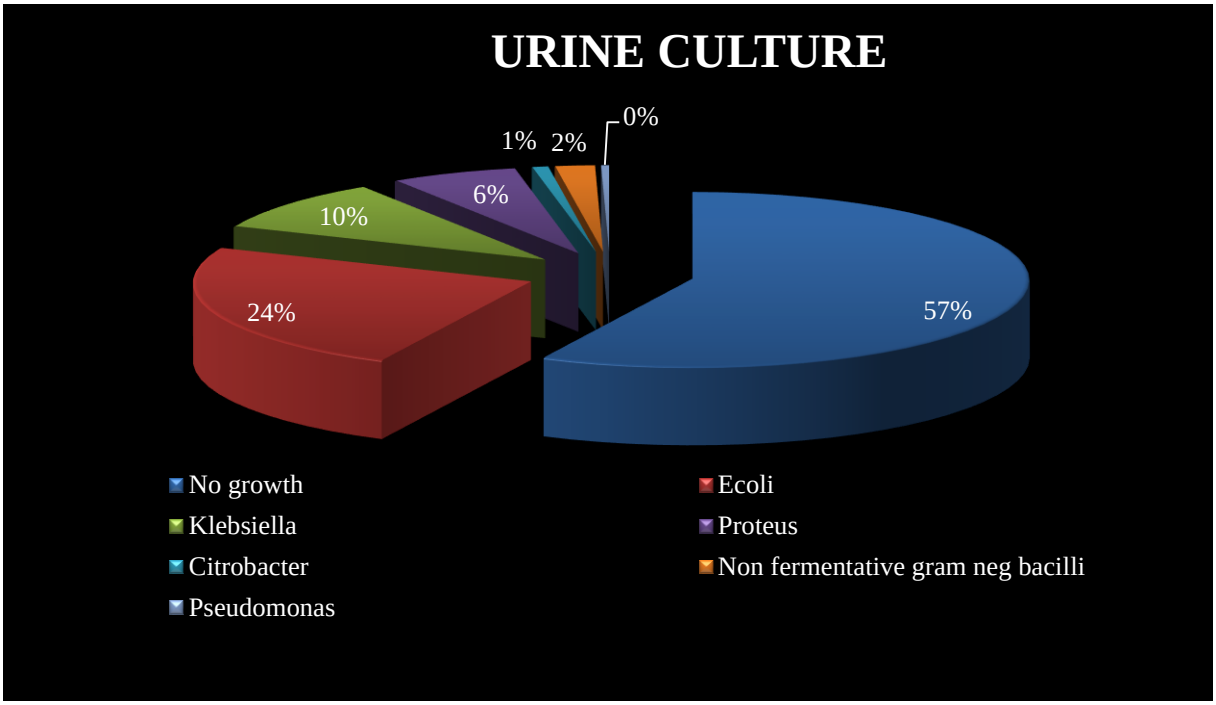

Figure 24 DISTRIBUTION OF ORGANISMS IN URINE CULTURE

Colony count was seen . Those with colony count >10^5 of single group of organisms were taken as significant bacteriuria . Also those who were catheterised with colony count more than 5* 10^4 under catheterisation were taken as significant bacteriuria. Any number of organism isolated by supra pubic aspiration were considered as significant bacteriuria .But supra pubic aspiration being an invasive modality was not done in any of our cases.

Out of the 112 culture positive cases, 90(34%) had a colony count of >10^5 and was considered as significant bacteriuria.12 children who were catheterised had a colony count of >10^4 and was considered significant. They constituted 4.6% of the population.10 children had scanty growth in culture and were not considered as significant bacteriuria. So only 102 were considered culture positive.

Renal Function Test was done in all children .8 children had elevated renal parameter which were corresponding to an underlying morbidity . Out of the eight, two had posterior urethral valve , 3 had hydroureteronephrosis .Out of the 3 cases of hydroureteronephrosis ,one had primary VUR , one had antenatal Hydroureteronephrosis , one had PUJ obstruction . 3 had neurogenic bladder .Mean urea value measured was 25.73 with a standard deviation of +/- 8.1 .Mean creatinine value measured was 0.6 with standard deviation of 0.206 .

HEMATURIA:

Among 262 study population, hematuria was present in 44 children (16.8%). Sensitivity, specificity, positive predictive value and negative predictive value were 31.4%, 92.5% ,72.7 % and 67.9% respectively.

It was found that all the children with hematuria had ultrasound evidence of cystitis.

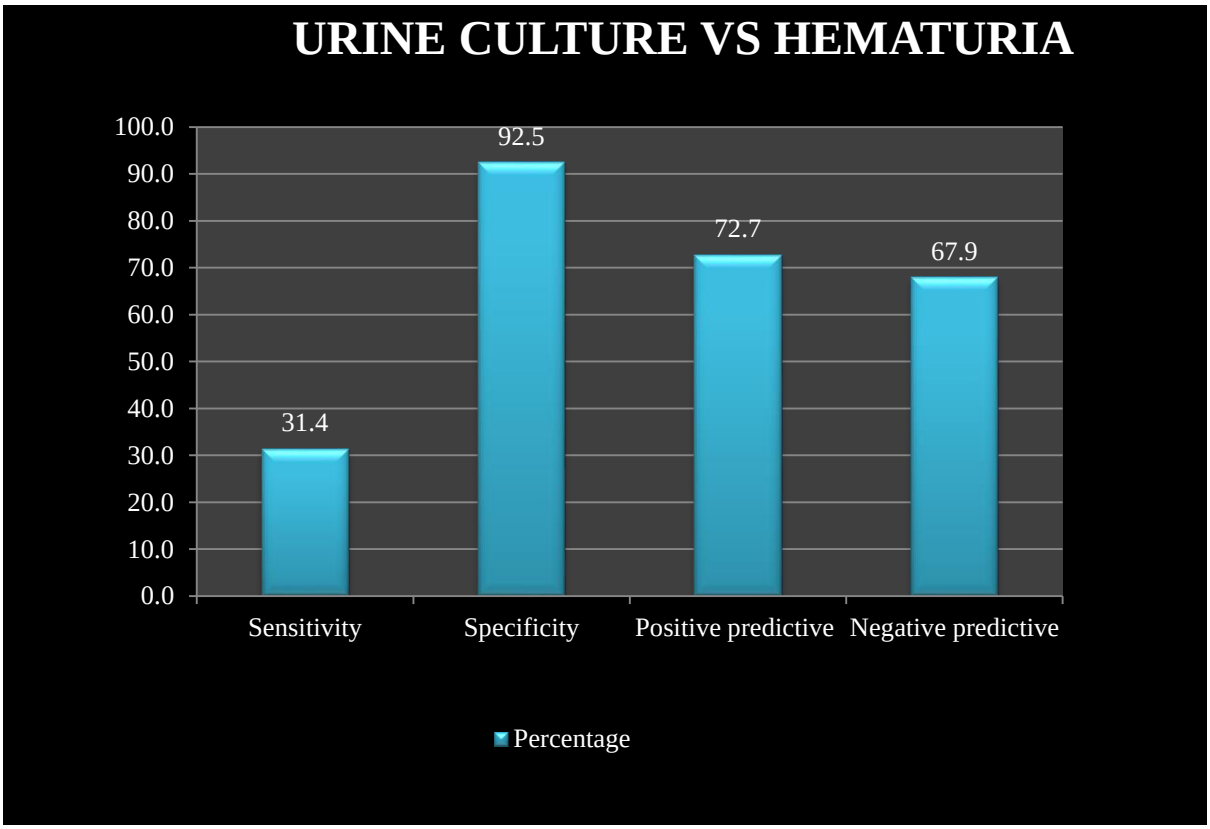

Figure 25 SENSITIVITY, SPECIFICITY, PPV AND NPV OF HEMATURIA.

USG ABDOMEN AND PELVIS :

USG Abdomen was done in all cases. Most common Ultrasound finding was cystitis in 41 cases (15.6%) followed by 5 cases of hydroureteronephrosis (1.9%) .Out of these 5 ,two were known cases of

posterior urethral valve, one was a case of Pelviureteric junction obstruction, one child was a known case of primary vesicourethral reflux followed by one case of antenatal hydroureteronephrosis and 3 cases were neurogenic bladder detected by thickened bladder >2 mm and post voidal residue of urine >20 ml. 4 cases of nephrotic syndrome had ascitis as finding .

TABLE 9-USG ABDOMEN AND PELVIS FINDINGS IN STUDY POPULATION

USG Abdomen And Pelvis	No Of Cases	Percentage
Normal	209	79.8
Ascitis	4	1.6
Cystitis	41	15.6
Hydroureteronephrosis	5	1.9
Neurogenic bladder	3	1.1
Total	262	100.0

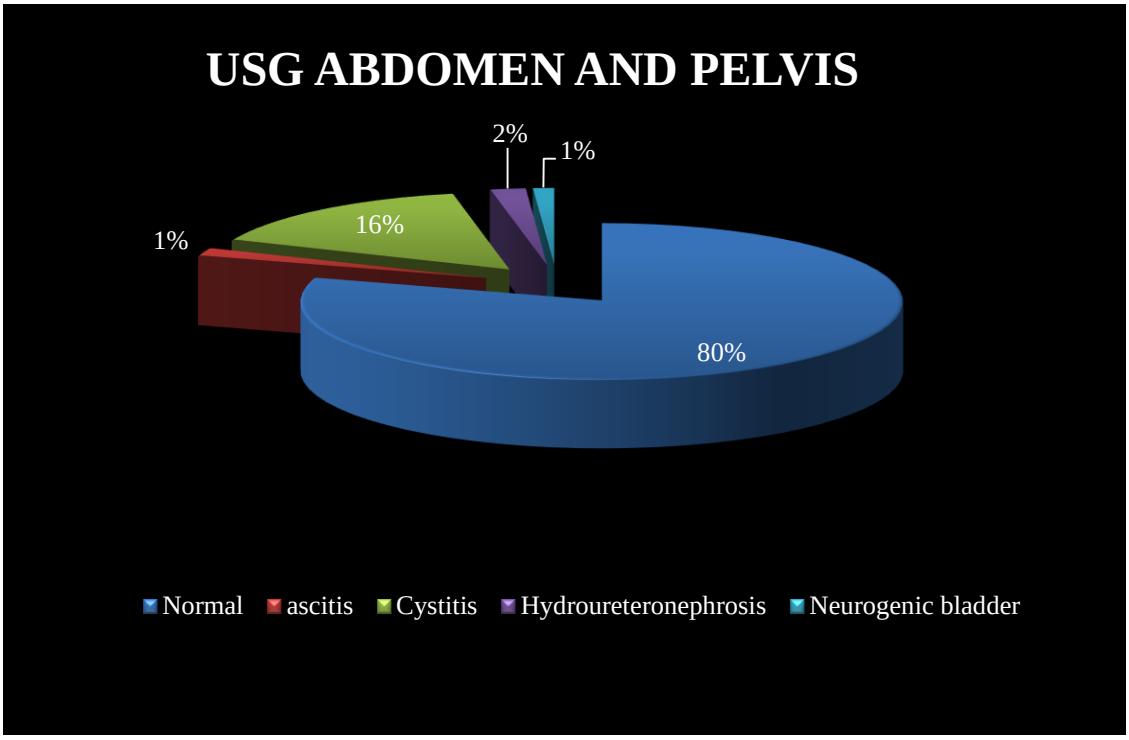

Figure 26 USG ABDOMEN AND PELVIS FINDINGS IN THE STUDY POPULATION

MICTURITING CYSTOURETHROGRAM :

Micturiting cystourethrogram was done in eligible cases -about 10 cases.8 children had abnormal reports .2 children had dilatation of the prostatic urethra and a linear filling defect corresponding to the area of the valves .This finding was suggestive of posterior urethral valve . one child had reflux into the upper collecting system without any dilatation of the ureter- suggestive of grade 2 vesicourethral reflux.Three children had incomplete emptying of bladder wall suggestive of neurogenic bladder.There was postvoidal residue of urine more than 20 ml .One child had grade 4 hydroureteronephrosis .One child had dilatation of renal pelvis with blunting of calcyceal fornices suggestive of grade 3 VUR .

TABLE 10 - ABNORMAL CASES IN MICTURITING CYSTOURETHROGRAM

MCU	No Of Cases	Percentage
Normal	2	20
Abnormal	8	80
Total	10	100.0

DISCUSSION

DISCUSSION AND DATA ANALYSIS

In the total 262 patients analysed , 38.9% were culture positive UTI .61.1 % were culture negative.

GENDER DIFFERENTIATION:

In our study, urinary tract infection occurred more in female children than in male children .**Culture positive female children constituted more than half of the study population .**

In the cross sectional study done by Gupta et al ,of the total number of cases studied ,69.4% were boys ie the majority population with UTI was boys ,that too they had high risk of vesicourethral reflux and renal scarring than girls. The reason could be because it included infants also .

Sumit et al did a study regarding the urinary tract infections in the pediatric population in north India .Among the population studied, UTI was higher in females than in the male population. Culture positive UTI was seen in 11.8% females as against 8.9% males.

In the study done by Nayak et al [(2)] , of the study population which included all age groups with symptoms suggestive of ,UTI was found to be more common in males -60% as against females 40 %. But age wise grouping have not been done in the study.

Sanath et al studied that during preschool and school age, females tend to suffer more episodes of UTI than males.He also observed that the risk of developing symptomatic UTI before the age of 14 years is 1-2% in boys and 3-8% in girls.

AGE OF PRESENTATION:

On assessment of age wise distribution of the study group ,in our study, UTI was more common in the 6-10 yrs age group(60.78%) followed by 0-5 yrs age group (34.3%)followed by >10 yrs (18.62%)

In the study done by Sumit et al [14], UTI was highest in >16 yrs age (30.58%) followed by 11-15 yrs (28.82%) followed 6- 10 yrs (20.58%) finally in the 0-5 yr agr group (20%).

Nayak et al [2] had his study results regarding age distribution as follows-5-12 yrs (46.4%) followed by 2-5 yrs (33.3%) followed by <2 yrs -20.3% , which is consistent with our study .

In the study by Mod HK et al[(13)] , 20.3 % were between 1 to 2 years of age, 33.3% were between 2 and 5 years and 46.4% were between 5 to 12 years of age.

By this , 6-10 yrs seems to be common age for UTI .

ETIOLOGY

Among the 102 culture positive organisms, the most common organism isolated was Ecoli followed by klebsiella then by , proteus ,followed by by non fermentative gram negative bacilli ,finally by citrobacter which constituted a very few percentage .

Comparing with other studies:

Our study showed that Ecoli was the most common organism .Our study result was comparable with Palak et al and A Sharma et al .Our results for klebsiella was comparable with Palak et al. Our study showed high percentage of proteus and no isolation of Pseudomonas .

	Our study	**Sumit gupta et al**	**Palak et al**	**A sharma et al**
ECOLI	51.9%	27.05%	68.3%	**67.5%**
KLEBSIELLA	24.5%	18.82 %	**21.12%**	20%
PROTEUS	15.6%	**11.76%**	4.22%	10%
PSEUDOMONAS	0%	8.23%	0.7%	

SYMPTOMATOLOGY:

On analysing the symptomatology ,in our study , most common symptom was dysuria followed by increased frequency of micturition, followed by persistent vomiting , abdominal pain, then by fever , then by hematuria, pyuria , followed lastly by constipation.

Fever as a symptom was present in less than half of cases .Out of this, fever of < one week was present in the majority, 1 week fever was present in few cases, more than one week fever was present was present only in very few children.

In the study done by Sumit Gupta et al[14] , most common symptom was fever followed by dysuria, followed by burning micturition, followed by abdominal pain, , smelly urine, followed by poor feeding , followed by vomiting.

In the study done by Tamilarasu et al [12], children from 2months to 12 yrs of age were studied for UTI in kancheepuram .The symptoms in descending order were dysuria , abdominal pain , fever, frequency of micturition ,vomiting ,oliguria .

Nayak et al [2] study showed that fever was the most common complaint followed by dysuria.

In our study, pallor was observed in few children , facial puffiness in few children .Pedal oedema was present in very few children. High grade temperature was recorded in less than children .

EXAMINATION FINDINGS:

Abdominal examination was normal in less than half the children, suprapubic tenderness was present in more than half the children.Lumbar tenderness was present only in very few children.

In our study , on genitourinary examination in male children,one tenth of the population had phimosis . Vulval synechia was not observed in any female children

All the children examined had a normal blood pressure.

Among the study population, one tenth of the children had associated comorbidities. The comorbidities noted in descending order were nephrotic syndrome , neurogenic bladder , posterior urethral valve , vesicourethral reflux , hydroureteronephrosis,PUJ obstruction.

DATA ANALYSIS:

Sensitivity (ability of the parameter to rightly diagnose UTI) , specificity (the ability of the parameter to rightly ruling out UTI), positive predictive value (the test when tested positive, the likely chances that the patient has UTI)and negative predictive value (the test when tested negative, the likely chances the patient doesn't have UTI) have been discussed comparing our study with old studies . This has been done for 4 parameters –pyuria, leucocyte esterase, nitrite and combined dipstick .:

PYURIA.

The sensitivity and specificity norms laid by AAP for pyuria were 73 % and 45-98% respectively . The sensitivity of pyuria in our study was around 60 % and was less than the norms laid by AAP and the specificity was around 80 % which comparable with AAP norms.

Our study is compared with four other studies for use of urine microscope in screening UTI , Our study shows low sensitivity, more specifity and negative predictive value for urine microscopy in detecting UTI .Positive predictive value of our study was consistent with most of the studies .

Study	Sensitivity	Specificity	PPV	NPV
Our study	**64.7%**	80.6%	**68.0%**	78%
Gorelick Shaw et al[8]	82%	87%	15%	
Mod hk et al[13]	**63.5%**	25%	**70%**	20%
Eric et al[26]	90.3%	91.3%	58.6%	98.6%
Nayak et al[2]	**63.5%**	25%	70%	19%
Hoberman et al	**54 %**	96 %		

LEUKOCYTE ESTERASE:

The sensitivity for leucocyte esterase laid by AAP norms was 83 % (67-94 %) which was in range with our study .The specificity laid by AAP norms was 78%(64-92%) which was in range with our study .

Comparing our study with 4 other studies , in our study sensitivity was very high compared to other studies. The specificity in our study was high and comparable to most of the studies .Positive predictive value of leukocyte esterase was less and was in range with most of the studies. Negative predictive value in our study was high and was in range with most of the studies .

Study	Sensitivity	Specificity	PPV	NPV
Our study	90%	78.7%	**73%**	**92.6%**
Ruchika et al [23]	51.2%	92%	60.2%	**88.9%**
Nayak et al[2]	61%	25%	**69%**	19%
Mod hk et al [13]	61%	25%	**69%**	18.5%
Tamilarasu et al[12]	61.22%	98.8%	90.91%	**92.88%**

NITRITE :

The sensitivity for nitrite laid by AAP norms was 53 %(15- 82 %) but our study showed higher sensitivity. The specificity laid by AAP norms was 98 %(90-100%) which was in range with our studies.

Our study has been compared with 4 other studies for analysing the performance characteristics of nitrite in diagnosing UTI. Ratna Barel et al [24] did a study on urine samples , and tested the efficacy of urine nitrite alone in UTI , found that it is highly specific.Most of the studies showed a specificity of around 90 % .

Similarly in our study also , nitrite was highly specific , and had a good negative predictive value in diagnosing UTI . In contrast to other studies , our study showed a high sensitivity for nitrite test .Positive predictive value was also good compared with other studies .

Study	Sensitivity	Specificity	PPV	NPV
Our study	85.3%	92.5%	87.9%	90.8%
Ratna baral et al	69.04%	**89.4%**	63%	**91.6%**
Tamilarasu et al	10.2%	100%	100%	**85.03%**
Mod hk et al	50%	31%	66%	18.5%
Nayak et al	68%	25%	71.4%	22%
Antwi s et al	96.7%	58.8%	26%	99.2%
Walter ljm et al[27]	45-60%	**85-98 %**		
Gabrielle j williams et al[20]	41-57 %	**96-98 %**		

COMBINED LEUKOCYTE ESTERASE AND NITRITE (DIPSTICK) :

The sensitivity of combined dipstick laid by the AAP norms was 93 %(90-100 %) which was in par with our study findings .The specificity of combined dipstick laid by AAP norms was 72 %(58-91%) which was in par with our study.

On comparing our study to other studies regarding the utility of combined dipstick in diagnosing UTI, Our study showed a very good sensitivity , moderately good specificity, good negative predictive value and relatively good positive predictive values compared to other studies. Majority of studies had sensitivity around 60-70% which is in contrast with our study .Our study had the maximum sensitivity. Majority of studies had specificity > 80 % which is in par with our study .

Study	Sensitivity	Specificity	PPV	NPV
Our study	**96%**	**80.6%**	75.9%	**96.9%**
Gorelick and shaw et al[8]	73%	99%	61%	
Eric et al[26]	**90.8%**	93.8%	66.8%	**98.7%**
Ruchika et al[23]	62.2%	**82.8%**	45.9%	**90.3%**
Nayak et al[2]	68%	25%	**71.4%**	22%
Mod hk et al[13]	68%	25%	**71.4%**	22%

The specificity of Ruchika et al [23]studies was consistent with our study .Our study findings were inconsistent with Nayak et al and Mod Hk et al studies, as they show low sensitivity and specificity compared to our study .The drawback of Nayak et al and Mod k et al studies were relatively small sample size and lack of standardization of urine sample.

Sensitivity is almost equal for leukocyte esterase, nitrite and combined dipstick but less for microscopic analysis .

While the specificity is almost equal for microscopic analysis, leukocyte esterase and combined dipstick, it is high for nitrite alone .

USG ABDOMEN AND PELVIS:

In our study, USG Abdomen was done in all cases. Most common Ultrasound finding was cystitis followed by hydroureteronephrosis followed by ascitis followed by neurogenic bladder.

Mod et al in his study on UTI stated , of the USG done in all the cases, one third of cases had some abnormality ,most common finding

was cystitis ,which was consistent with our study .Next common finding was hydronephrosis, being one fifth of the study population.. The number is not very huge in our study for hydronephrosis ,probably because we did not include <2yrs in our study .So , there could be bias in anamoly detection. Very few had calculus and medical renal disease in the reference study .Our study did not have any such finding

Another study done in Govt Stanley Medical College, Chennai regarding the clinicodemographic profile of UTI in children >2 yrs ,most common findings were cystitis and splenomegaly followed by hydronephrosis , rest were normal . Here the findings of hydronephrosis has been consistent with our study.

MICTURITING CYSTOURETHROGRAM:

In our study, of the abnormal MCU reports ,one fourth children had posterior urethral valve. One tenth had grade 2 and grade 3 vesicourethral reflux each .One third of the abnormal reports were neurogenic bladder . One tenth had grade 4 hydroureteronephrosis.

In a study done by Mod et al ,only very few cases had abnormal findings in MCU , but the findings were not specified .

In the study in the Govt Stanley Medical college on UTI , a very few had abnormality in MCU , half of them had vesicoureteral reflux and half had bilateral double ureters .

CONCLUSION

CONCLUSION

1) Sensitivity, positive predictive value and negative predictive value of urine microscopic analysis is very less. Hence it cannot be reliably used in screening for UTI.

2) Leukocyte esterase has a good sensitivity, moderate specificity, hence it is a good screening test for UTI .

3) Nitrite has good sensitivity and specificity, hence can be used reliably for diagnosing UTI.

4) Combined dipstick has a good sensitivity ,specificity ,positive and negative predictive values compared to urine culture .Leukocyte esterase alone has a good sensitivity , nitrite has a good specificity , combined dipstick has a good sensitivity as well as specificity , and can be used reliably for diagnosing UTI while awaiting urine culture reports .

LIMITATIONS

LIMITATIONS OF THE STUDY

1)< 2yrs are not included in the study. Hence the utility of dipstick in this age group cannot be detected.(<2 yrs excluded because of decreased chances of urinary retention for four hours which is a requirement for nitrite test , difficulty in urine collection in children who are not yet toilet trained).

2) Gram stain for bacteriuria is not given importance in the study .

RECOMMENDATIONS

RECOMMENDATIONS

A. Urine microscopic analysis is not a reliable screening test.

B. Leukocyte esterase with its high degree of sensitivity can be used singly as a good screening tool .

C. Nitrite with its high degree of specificity can be used singly as a diagnostic test .

D. Combined dipstick with nitrite and leukocyte esterase has a good sensitivity and specificity and hence is better than leukocyte esterase or nitrite alone in diagnosing UTI .

E. Combined dipstick can be used reliably as a rapid screening tool for UTI in 1)busy office practice 2) Rural area where culture facilities are not available

F. Treatment can be started confidently by the results given by the dipstick while urine culture reports are awaited.

G. Option of antibiotics can be made based on nitrite positivity, as only gram negative organisms reduce nitrate to nitrite.

H. Even in facilities where microscope is available, in case of delay in examination following the collection of sample ,dipstick can be reliably used , as leucocyte esterase can be detected even in lysed cells , while we cannot visualise the lysed pus cells in microscopy .

ANNEXURES

BIBLIOGRAPHY

1) Jack S. Elder. Urinary tract infections. Nelson Textbook of Pediatrics Pg-

2) Nayak U.S, Solanki H, PatvaP.Utility of diptick vs culture in the diagnosis of urinary tract infection in children. Gujarat Med J. 2010 Feb; 65(l):20-22.

3) Vijayakumar.M, Kanitkar.M. Nammaiwar BR. Bagga. A Revised statemkent on Management of urinary tract infection. Indian Pediatr, 2011’ Sep;48(9):709-7 1 7

4) Ramazan M, Hatice Yuksel, Hayriye A.Y, Oziem Y.. Performance Characteristics of Dipstick and Microscopic Urinealysis for Diagnosis of Urinary tract infection. Eur J Gen Med 2010;7(2):174-179

5) Srivastava RN, Bagga A Urinary tract infectios, Pediatric Nephrology.

6) Nader Sheikh, MD, MDE-1. Prevalence of Urinary tract infection in children. Pediatr lntct Dis J 2008(27:302- 308)

7) Ferrara P, Rornaniello L, Vitelli 0. Gatt A, Serva M, Cataldi L. Cranberry juice fbt the prevention of recurrent UTI: A randomized controlled trial in children, Scandanavianjurnal of Urology and Nephrology 2009;43:369-72

8) Shaw KN, GorelickMH.Urinary Tract Infection in pediatric patient. PCNA 1999;46:6

9) Hoberman A, Cha HP, Keller DM, Hickey R, Davis HW, Ellis D. Prevalence of urinary tract infection in febrile infants. J Pediatr1993;123:17-23

10) Goldsrnith BM, Campos JM. Comparison of urine dipstick, microscopy and dipstick for detection of bacteriuria in children. ClinPediatr1990; 29:214.

11) Hoberman A. Enhance urinalysis as a screening test for urinary tract infection.Pediatr 1991; 91:1197-99.

12) *P. T. Tamizharasu,* utility of dipstick versus urine culture in diagnosis of urinary tract Infection in children. National Journal of Research in Community Medicine, Vol.5. Issue 4. Oct.-Dec.-2016

13) *Mod HK et al. Int J Contemp Pediatr. 2017 May;4(3):790-795* Urinary tract infection in children: clinical aspects and utility of urine dipstick test

14) Sumit Gupta , Urinary tract infection in pediatrics patients in north India *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*

15) Indian Pediatric Nephrology Group. Consensus statement on management of urinary tract infections. Indian Pediatr. 2001; 54:911-9.

16) Antwi S, Bates I, Baffoe-Bonnie B, Critchley J. Urine dipstick as a screening test for urinary tract infection. Annals Tropic Pediatr. 2008;28(2):117-22.

17) Sanath P Lamabadusuriya - A prospective study of urinary tract infections in children. Sri Lanka J Child Health. 2001;30:31-6.

18) MunaM, Buzavan, MScI.RajahS.Tobgi. Comparison of urine culture. microscopy and nitrite dipstick test in detection of urinary tract infection. JBMS. July 2008, vol 20 (3).

19) Adeleke,S.I,Asani,M.O, and Nwokedi. Assessment of leukoce esterase dipstick test in the diagnosis of childhood urinary tract infection. AFR. J. CLN. EXPER. MICROBIOL l0(l):l0-14

20) Walter LJM Deville, Jois C Yzemans, Nico P vn Duijin, P Dick Bezme, Danielle AWN van der Windt, Lex M Bouter. The urine dipstick test useftil to rule out infections, Ameta analysis of the accuracy.BMC Urology June 2004;4:4 V

21) Gabrielle J Williams, Petra Macaskill, Siew F Chan, Robin M Turner Elisabeth Hodson, Jonathan C Craig. Absolute and relative accuracy of rapid urine tests for urinary tract infection in children a meta-analysis. The Lancet Infectious Diseases,2010 April 1 0(4): 240-250.

22) National Institute for Health and Clinical Excellence (NICE). UTI in children. Diagnosis, treatment and long term management. NICE: 2007

23) Ruchika Bagga Urinary Dipsticks: Efficacy as Predictor of Urinary Tract Infections; jornal of bacteriology and mycology.

24) Ratna Baral, Rapid Nitrite Dip Stick Vs Urine culture for diagnosis of Urinary tract Infections; *International Journal of Biomedical Research* 2017; 8(04): 204-209.

25) Sara Najeeb, Tehmina Munir Comparison of Urine Dipstick Test with Conventional Urine Culture in Diagnosis of Urinary Tract Infection; Journal of the College of Physicians and Surgeons Pakistan 2015, Vol. 25 (2): 108-110

26) Eric W. Glissmeyer, MD,a,b E. Kent Korgenski, MS,a,c Jacob Wilkes, Dipstick Screening for Urinary Tract Infection in Febrile Infants; PEDIATRICS Volume 133, Number 5, May 2014 e112

27) The urine dipstick test useful to rule out infections. A meta-analysis of the accuracy; Walter LJM Devillé*1,2, Joris C Yzermans3, Nico P van Duijn; *BMC Urology* 2004, 4:4

28) Bryant K, Maxfield C, Rabalais G. Renal candidiasis in neonates with candiduria. Pediatr Infect Dis J 1999;18(11):959 – 63.

29) Phillips JR, Karlowicz MG. Prevalence of Candida species in hospital acquired urinary tract infections in a neonatal intensive care unit. Pediatr Infect Dis J 1997;16(2):190 – 4.

30) Loening-Baucke V. Urinary incontinence and urinary tract infection and their resolution with treatment of chronic constipation of childhood. Pediatrics. 1997;100:228–32.

31) Koff SA, Wagner TT, Jayanthi VR. The relationship among dysfunctional elimination syndromes, primary vesicoureteral reflux and urinary tract infections in children. J Urol. 1998;160:1019–22

32) Smellie JM, Hodson CJ, Edwards D, et al. Clinical and radiological features of urinary infection in childhood. BMJ 1964; 5419: 1222 – 6.

33) Struthers S, Scanlon J, Parker K, Goddard J, Hallett R. Parental reporting of smelly urine and urinary tract infection. Arch Dis Child. 2003;88:250–2.

34) Leong YY, Tan KW. Bladder aspiration for diagnosis of urinary tract infection in infants and young children. J Singapore Paediatr Soc. 1976;18(1):43– 47.

35). Pryles CV, Atkin MD, Morse TS, Welch KJ. Comparative bacteriologic study of urine obtained from children by percutaneous suprapubic aspiration of the bladder and by catheter. Pediatrics.

36). Djojohadipringgo S, Abdul Hamid RH, Thahir S, Karim A, Darsono I. Bladder puncture in newborns: a bacteriological study. Paediatr Indones. 1976;16(11–12):527–534.

37). Kramer MS, Tange SM, Drummond KN, Mills EL. Urine testing in young febrile children: a risk-benefit analysis. J Pediatr. 1994;125(1):6 –13.

38) Bonadio WA. Urine culturing technique in febrile infants. Pediatr Emerg Care. 1987;3(2):75–78.

39) Bulloch B, Bausher JC, Pomerantz WJ, Connors JM, Mahabee-Gittens M, Dowd MD. Can urine clarity exclude the diagnosis of urinary tract infection? Pediatrics. 2000;106:E60.

40) Rawal K, Senguttuvan P, Morris M, Chantler C, Simmons NA. Significance of crystal clear urine. Lancet. 1990;335:1228.

41). Tremblay S, Labbe J. Crystal-clear urine and infection. Lancet. 1994;343:479–80.

42) Pitetti RD, Choi S. Utility of blood cultures in febrile children with UTI. Am J Emerg Med. 2002;20:271–4.

43) Bachur R, Caputo GL. Bacteremia and meningitis among infants with urinary tract infections. Pediatr Emerg Care. 1995;11:280–4.

44) American Academy of Pediatrics, Committee on Quality Improvement, Subcommittee on Urinary Tract Infections. Practice parameters: The diagnosis, treatment and evaluation of the initial

urinary tract infections in febrile infants and young children. Pediatrics. 1999;103:843-52.

45) Singh-Grewal D, Macdessi J, Craig J. Circumcision for the prevention of urinary tract infection in boys: a systematic review of randomized trials and observational studies. Arch Dis Child. 2005;90:853-8.

46). Peters CA, Skoog SJ, Arant BS, Copp HL, Elder JS, Hudson RG, et al; American Urological Association Education and Research, Inc. Summary of the AUA guideline on management of primary

47) Pediatric clinics of North America. Pediatr clin N Am. 2006:53:379- 400.

48) Indian Pediatric Nephrology Group. Consensus statement on management of urinary tract infections. Indian Pediatr. 2001;38:1106-15.

49) Jojart G. Comparison of 3-day versus 14-day treatment of lower urinary tract infection in children. Int Urol Nephrol 1991; 23(2):129– 34.

50) Hoberman A, Wald ER, Hickey RW, Baskin M, Charron M, Majd M, et al. Oral versus initial intravenous therapy for urinary tract infections in young febrile children. Pediatrics. 1999;104:79–86.

51). Baker PC, Nelson DS, Schunk JE. The addition of ceftriaxone to oral therapy does not improve outcome in febrile children with

urinary tract infections. Arch Pediatr Adolesc Med. 2001;155: 135–9.

52) Keren R, Chan E. A meta-analysis of randomized, controlled trials comparing short- and long-course antibiotic therapy for urinary tract infections in children. Pediatrics. 2002;109:E70.

53). Michael M, Hodson EM, Craig JC, Martin S, Moyer VA. Short versus standard duration oral antibiotic therapy for acute urinary tract infection in children. Cochrane Database Syst Rev. 2004; (4):CD003966

54) Tran D, Muchant DG, Aronoff SC. Short-course versus conventional length antimicrobial therapy for uncomplicated lower urinary tract infections in children: a meta-analysis of 1279 patients. J Pediatr. 2001;139:93–9.

55) Gauthier M, Chevalier I, Sterescu A, et al. Treatment of urinary tract infections among febrile young children with daily intravenous antibiotic therapy at a day treatment center. Pediatrics 2004;114(4):e469–76.

56) Baskin MN, O'Rourke EJ, Fleisher GR. Outpatient treatment of febrile infants 28 to 89 days of age with intramuscular administration of ceftriaxone. J Pediatr 1992;120(1):22 – 7.

57). Currie ML, Mitz L, Raasch CS, Greenbaum LA. Follow-up urine cultures and fever in children with urinary tract infection. Arch Pediatr Adolesc Med. 2003;157:1237–40.

58) Joseph J.Zorc DAK and KNS.Diagnosis and Management of Pediatric. Urinary Tract lnfetio.ns.ClinMicrobio1 Rev. 1 8(2):41 7-22.

59) Taneja N, Chatterjee SS, Singh M, Singh S, Sharma M. Pediatric urinarytract infections in a tertiary care center from north india. Indian J MedRes. 2OlO Jan; 1310:101- 5.

60) Chandrashekar G.S, Divakar R, I?avan H, Santosh S. Routine. Urineculture in febrile young children. J Clin Diagnostic Research. 2011June; 5(3):452-55.

61) Matthai J RM. Urine analysis in urinary tract infection.Indian J Pediatr.1995 Nov-Dec;62(6):713-6.

62) KathyN Shaw,KarinL Maid-I Gorelick J S Schwartz Screening for Urinary tract Infection in the Emergency Department: Which test is best? Ediatrics J 1998J01(6):l- 5

63) Steven L.Chang, MD. Linda ID Pediatric urinary tract infections. Pediatric Clin N Am 2006:53:379-400

64) Liao J.C.,Churchill B.M., Pediatric urine testing. Pediatr. Clin. N. America 2001; 68(6): 1425-58.

65) Hardy J.D, Furnell P.M., Brumfit.W, Comparison of sterile bag, clean catch and suprapubic aspiration in the diagnosis of UTI in early childhood

66) Jackson C.G, Dallenbach F.D, Kipnis G.P, Pyelonephritis: correlation of clinical and pathological observation in the antibiotic era. Med Clinics of N.America, 1995;39:297

67) Campbell M.F Clinical pediatric urology, Philadelp1ia, 'Saunders 1951:355

68) Ferrara P, Rornaniello L, Vitelli 0. Gatt A, Serva M, Cataldi L. Cranberry juice fbt the prevention of recurrent UTI: A randomizedcontrolled trial in children, Scandanavianjurnal of Urology and Nephrology 2009;43:369-72.

69) Benador D, Benador N, SiosmanDO, Nussle, Mermillod B, Girardin E. Cortical scintigraphy in the evaluation of renal parenchymal changes in children with pyelonephtis, J Pediatr 1994; 124: 17-20.

70) Rushton HG, Majd M, Jantausch B, Wiedermann BL, Belman AB. Renal scarring following reflux and non refluxpyelonephrirtis in children: Evaluation with a 99m technetiurn-dimercatosuccinic acid scintigraphy. JUro11992 ;147:1327-32

71) Shlager TA.UTI in children younger than 5 years of age Epidemiology, Diagnosis, Treatment, Outcome and Prevention. Pediatric Drugs2001;3(3):219-227

72) Kaushal RK. Bansal S. Sharma VK. Sod A., GoyalA.Urinay tract infection among children presenting with fever. Indian Pediatr 2003:40:269-270.

73) Shaikh N, Morone NE, Lopez J. Does this child have a urinary tract infection'? JAMA 2007;298(24):2895-904.

74) Leroy S and Garvaix A. Procalcitonin: A key marker in children with urinary tract infoction. Advances in Urology 2011; 115: 225-32.

75) Jacobsen SM, Stickler DJ, Mobley HLT, Shirtliff ME. Complicated catheter associated UTI due to Escherichia Coli and Proteus Mirabilis. Clinical Microbiology Reviews 2008:26-59

76) Nowell L, Moran C, Smith PB, Seed P, Alexander BD, Cotton CM et al.Prevalence of Renal Anomalies following UTI in hospitalized infants less than two months ofage.J Perinatology 2010;30(4):281-85.

77) Saadeh SA and Mattoo TK. Managing UTI. Pediatric Nephrol 201l; 26:l967-76.

78) Chris H Chon, MD, Frank C,Lai, MD.Pecliatric Urinary Tract Infections. Pediatric Clinics of North America 2001:48(6):! 441-1459.

79)] John Dotis, Nikoleta Printza, Alexandra Marneri, DimosG idaris, Fotios Papachristou . Urinary tract infections caused by extended spectrum betalactamasse producing bacteria in children matched case control study. Turk J Pediatric 2013 Nov-Dec;55(6):571-4.

80)] KizilkaO.Risk factors for community-acquired urinary tract infection Caused by ESBL producing bacteria in children. Pediatr mt. 2012 De54(6):858-62

81) Revised AAP guidelines on UTI in febrile infants and young children Am Farn Physician.201 2 Nov 1 5;86(I 0):940-946

82)] LohrJA, Portilla MG, Gender TG, Dunn ML, Dudly SM,, Making a presunptive diagnosis of urinary tract infection by using a urinalysis performed in an on-site laboratory. JPediatr 1993;122:22-25

83). Coulthard MG, Nelson A, Smith T, Perry JD. Point of casre. diagnostic tests for childhood urinary tract infection: phase contract microscopy for bacteria, stick

84) Thayyil-Sudhan S, GuptaS. Dipstick examination for urinary tract infection. Arch Dis Child 2000:82: 271 V

85) B.Lejeune, R Baron, B.Guillois V and 0 Mayeux. Evaluation of screening test for detecting urinary tract infection in newborn and infants. JClin Pathol. Dec 1991 ;44(12): 1 029.l030

86) Bachur R, Caputo GL. Bacteremia and meningitis among infants with urinary tract infections. Pediatr Emerg Care. 1995;11:280–4

ABBRIEVATIONS

UTI	–	urinary tract infection
E. coli	–	Escherichia coli
NICE	–	National Institute for Health and Clinical Excellence
USG	–	ultrasonogram
DMSA	–	dimercapto succinic acid
VCUG	–	voiding cysto urethrogram
MCU	–	micturating cysto urethrogram
VUR	–	vesico ureteric reflux
IAP	–	Indian Academy of Paediatrics
AAP	–	American Academy of Pediatrics

PROFORMA

Name:

Age /sex: Address:

Date of attending op: Date of admission:

Date of discharge

COMPLAINTS:

Fever :

Duration :

Abdominal pain :

Dysuria :

Urgency :

Frequent micturition :

Hematuria :

Pyuria :

Persistant vomiting :

Previous urinary tract surgery :

Constipation :

EXAMINATION FINDINGS:

pallor / facial puffiness/ pedal edema

VITALS:

Blood pressure : Temperature:

SYSTEMIC EXAMINATION:

P/A : suprapubic tenderness, renal angle tenderness, renal mass, palpable or distended bladder, impacted hard stools

OTHER SYSTEM :

Genitourinary examination: phimosis /vulval synechiae

External markers of neural tube defect :

INVESTIGATION :

Urine microscopy (centrifuged sample)	**Urine dipstick**	**Urine culture**	**Colony count**
No . of pus cells -	nitrite :+/- leucocyte esterase :+/-	Growth/ no growth	<100 100-100,000 >100,000

RFT

Urea : Creatinine :

USG abdomen/pelvis :

MCU :

MASTER CHART

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
1	8	2	p	1	p	p	p	p	p	p	p	n	p	n	n	n	0	1	1	0	n	N	0	3	4	2	p	1	3	26	1	1	
2	4	1	p	1	n	n	n	n	n	p	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	0	p	1	3	30	1	0	
3	5	2	p	1	p	p	p	p	p	p	p	n	n	n	n	n	0	1	1	0	n	N	2	2	0	2	p	2	3	41	1	4	1
4	6	1	p	1	p	p	p	p	n	p	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	2	p	5	3	16	0	0	
5	7	2	p	1	n	n	n	n	n	p	p	n	n	n	n	n	0	1	1	0	n	N	0	1	0	3	p	1	3	28	0	0	
6	8	2	p	1	p	p	p	p	n	p	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	3	p	1	3	30	0	0	
7	4	1	p	1	p	p	p	p	n	p	p	n	n	n	n	n	0	1	1	1	n	N	0	0	0	3	p	1	3	16	0	0	
8	5	1	p	1	p	p	p	p	p	p	p	n	n	n	n	n	0	1	1	1	n	N	0	2	4	3	p	1	3	25	0	1	
9	7	1	p	1	p	p	p	p	p	p	p	n	n	n	n	n	0	1	1	0	n	N	0	2	3	3	p	2	3	18	1	1	
10	8	2	p	1	p	p	p	p	p	p	p	n	n	n	n	n	0	1	1	0	n	N	0	0	3	3	p	3	3	15	1	1	
11	6	1	p	1	p	p	p	p	p	p	p	n	n	n	n	n	0	1	1	0	n	N	0	2	3	3	p	5	3	16	1	1	
12	5	1	p	1	p	p	p	p	n	p	p	n	n	n	n	n	0	1	1	0	n	N	2	0	2	3	p	2	3	44	1	4	1
13	9	2	p	1	p	p	p	p	n	p	p	n	n	n	n	n	0	1	1	0	n	N	0	0	0	3	p	1	3	23	1	0	
14	10	2	p	1	p	p	p	p	n	p	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	2	p	1	3	18	1	0	
15	11	1	p	1	p	p	p	p	n	p	p	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	1	3	26	1	0	
16	4	2	p	1	p	p	p	p	n	p	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	2	p	2	3	24	1	0	
17	5	2	p	1	p	p	p	p	n	p	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	2	p	3	3	20	1	0	
18	6	2	p	1	p	p	p	p	n	p	p	n	p	n	n	n	0	1	1	0	n	N	0	0	0	2	p	5	3	28	1	0	
19	4	2	p	1	p	p	p	p	p	p	p	n	n	n	n	n	0	1	1	0	n	N	0	1	2	2	p	1	3	16	1	1	
20	8	1	n		p	p	p	p	p	p	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	2	p	2	3	20	1	1	
21	6	1	n		p	p	p	p	p	p	p	n	n	n	n	n	0	0	1	1	n	N	0	2	0	2	p	2	3	18	1	1	
22	7	1	n		p	p	p	p	p	p	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	2	p	3	3	16	1	1	
23	5	2	n		p	p	p	p	p	p	p	n	n	n	n	n	0	0	1	0	n	N	0	0	3	2	p	1	3	17	1	1	

24	9	2	n		p	p	p	p	n	p	p	n	n	n	n	n	0	0	1	0	n	N	0	0	3	2	p	2	3	16	1	0	
25	10	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	1	1	35	1	0	
26	11	1	n		p	p	p	p	p	p	p	n	n	n	n	n	0	0	1	0	n	N	0	2	0	0	n	1	3	18	1	1	
27	3	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	Y	0	0	1	2	p	1	2	24	1	0	
28	4	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	1	n	N	0	0	1	0	p	1	1	38	1	0	
29	5	2	n		p	p	p	p	p	p	p	n	n	n	n	n	0	0	1	0	n	N	0	0	1	3	p	3	3	25	1	1	
30	6	1	n		p	p	p	p	n	p	p	n	n	n	n	n	0	0	1	0	n	N	0	0	1	2	p	2	3	26	1	0	
31	8	1	n		p	p	p	p	n	p	p	n	n	n	n	n	0	0	1	0	n	N	0	0	1	2	p	4	3	24	1	0	
32	7	2	n		p	p	p	p	n	p	p	n	n	n	n	n	0	0	1	0	n	Y	0	1	0	0	n	4	2	25	1	0	
33	9	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	2	p	1	3	26	1	0	
34	4	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	2	0	0	n	1	1	34	1	0	
35	6	1	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	1	n	N	0	0	0	0	n	1	1	25	1	0	
36	8	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	Y	0	0	2	2	p	1	2	34	1	0	
37	5	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	2	0	0	n	1	1	14	1	0	
38	10	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	Y	0	0	0	0	n	1	2	16	1	0	
39	12	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	1	1	16	1	0	
40	11	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	1	3	2	p	2	3	14	1	0	
41	4	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	2	0	0	n	1	1	23	1	0	
42	6	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	3	4	3	p	6	3	26	1	0	
43	3	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	0	p	0	1	34	1	0	
44	8	2	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	0	n	N	0	2	2	0	p	1	1	28	1	0	
45	7	2	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	0	p	1	1	34	1	0	
46	8	1	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	2	2	0	p	1		17	1	0	
47	9	2	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	1	0	p	3	3	28	1	0	
48	6	2	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	Y	0	0	3	0	p	1	2	24	1	0	
49	9	2	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	1	0	p	1		19	1	0	
50	5	2	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	3	4	3	p	3	3	17	1	0	
51	7	2	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	1	0	p	1		23	1	0	
52	3	2	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	1	0	p	3	3	25	1	0	

53	8	2	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	1	1	0	p	1		26	1	0	
54	6	1	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	1	0	p	1		27	1	0	
55	8	1	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	1	n	N	0	1	1	0	p	1	3	24	1	0	
56	4	2	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	1	0	p	2	3	26	1	0	
57	3	1	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	2	0	0	n	0		16	1	0	
58	8	1	p	2	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		28	1	0	
59	6	1	p	2	p	p	p	p	n	n	p	n	p	n	n	n	0	1	1	0	n	N	0	0	1	2	p	3	3	36	1	0	
60	8	2	p	1	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	1	1	1	p	3	3	27	1	0	
61	9	2	p	1	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	1	p	2	3	40	1	0	
62	3	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	1	p	1	3	36	1	0	
63	4	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	Y	0	2	3	2	p	1	2	26	1	0	
64	5	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	Y	0	2	3	2	p	1	2	16	1	0	
65	6	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	3	2	p	1	3	28	1	1	
66	7	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	2	3	2	p	2	3	34	1	0	
67	8	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		26	1	0	
68	9	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		36	1	0	
69	12	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	2	0	0	n	0		25	1	0	
70	11	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		16	1	0	
71	10	1	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		37	1	0	
72	5	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	3	0	0	n	0		25	1	0	
73	6	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		34	1	0	
74	8	1	n		p	p	p	p	p	n	p	n	n	n	n	n	0	0	1	0	n	N	0	1	1	1	p	0		34	1	1	
75	9	1	n		p	p	p	p	p	n	p	n	n	n	n	n	0	0	1	0	n	N	0	1	1	0	p	0		26	1	1	
76	6	1	n		p	p	p	p	p	n	p	n	n	n	n	n	0	0	1	0	n	N	0	1	1	0	p	0		16	1	1	
77	5	1	n		p	p	p	p	p	n	p	n	n	n	n	n	0	0	1	0	n	N	0	1	1	0	p	0		24	0	1	
78	4	2	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		34	1	0	
79	3	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		15	1	0	
80	12	1	p	1	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		16	1	0	
81	4	2	p	1	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		16	1	0	

82	5	1	p	1	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		26	1	0	
83	6	1	p	1	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		34	1	0	
84	8	2	p	1	p	p	p	p	p	n	p	n	n	n	n	n	0	1	1	0	n	N	0	1	1	0	p	0		26	1	1	
85	9	2	p	1	p	p	p	p	p	n	p	n	n	n	n	n	0	1	1	0	n	N	0	1	1	0	p	0		25	1	1	
86	12	2	p	1	p	p	p	p	p	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	2	p	3	3	16	0	1	
87	10	2	p	1	p	p	p	p	p	n	p	n	n	n	n	n	0	1	1	0	n	N	0	2	2	1	p	1	3	18	1	1	
88	4	1	p	1	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		20	1	0	
89	5	2	p	1	p	p	p	p	n	n	p	n	p	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		22	1	0	
90	7	2	p	1	p	p	p	p	n	n	p	n	p	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		24	0	0	
91	8	1	p	1	p	p	p	p	n	n	p	n	p	n	n	n	0	1	1	0	n	N	0	1	1	0	p	0		16	0	0	
92	9	2	p	1	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	2	1	p	2	3	34	0	0	
93	4	2	p	1	p	p	p	p	n	n	p	n	p	n	n	n	0	1	1	0	n	N	0	1	2	1	p	1	3	26	0	0	
94	5	1	p	1	p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	Y	0	0	2	1	p	1	2	16	0	0	
95	7	2	p		p	p	p	p	n	n	p	n	p	n	n	n	0	1	1	0	n	Y	0	1	2	1	p	1	2	26	0	0	
96	6	2	p		p	p	p	p	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	1	2	1	p	2	3	23	1	0	
97	7	1	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	1	n	N	0	0	2	1	p	2	3	25	1	0	
98	9	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	1	n	N	0	2	3	1	p	3	3	23	1	0	
99	4	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	1	n	N	0	2	3	1	p	5	3	16	0	0	
100	3	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	1	n	N	0	1	2	1	p	0	3	26	1	0	
101	7	1	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	0	n	N	0	0	2	1	p	5	3	27	1	0	
102	5	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	1	2	1	p	0		34	1	0	
103	4	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	1	2	1	p	3	3	15	1	0	
104	8	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	1	2	0	n	0		17	1	0	
105	9	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	0	n	0		24	1	0	
106	5	2	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	0	n	N	0	0	2	0	n	0		34	1	0	
107	3	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	0	n	0		37	1	0	
108	6	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	0	n	0		17	1	0	
109	7	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	0	n	0		19	1	0	
110	8	1	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	0	n	N	0	0	2	0	n	0		20	1	0	

111	9	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	0	n	0		21	0	0	
112	4	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	0	n	0		23	0	0	
113	3	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	2	0	n	0		24	0	0	
114	6	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		25	0	0	
115	7	2	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	1	n	N	0	0	0	1	p	0		26	0	0	
116	8	1	n		p	p	p	p	p	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	2	p	0		37	0	0	
117	9	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	1	n	N	0	0	0	3	p	0		24	1	0	
118	11	1	n		p	p	p	p	p	n	p	n	p	n	n	n	0	0	1	1	n	N	0	0	0	2	p	0		25	1	0	
119	12	2	n		p	p	p	p	n	n	p	n	p	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		15	1	0	
120	12	2	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		16	0	0	
121	7	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		23	1	0	
122	8	1	n		p	p	p	p	n	n	p	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		24	1	0	
123	8	1	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		25	1	0	
124	9	1	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	1	n	N	0	0	0	0	n	0		26	1	0	
125	6	1	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	1	n	N	0	0	0	0	n	0		23	1	0	
126	4	1	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		28	1	0	
127	5	2	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		24	1	0	
128	3	2	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		25	1	0	
129	7	1	n		n	p	p	p	n	n	p	n	p	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		24	1	0	
130	9	2	n		n	p	p	p	n	n	p	n	p	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		34	1	0	
131	6	2	n		n	p	p	p	n	n	p	n	p	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		35	1	0	
132	7	2	n		n	p	p	p	n	n	p	n	p	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		36	0	0	
133	5	2	n		n	p	p	p	n	n	p	n	p	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		37	0	0	
134	4	2	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		38	0	0	
135	7	2	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		15	0	0	
136	8	1	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		16	0	0	
137	9	1	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	1	2	1	p	0		18	0	0	
138	6	1	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	1	2	1	p	2	3	34	1	0	
139	7	2	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	1	2	1	p	1	3	33	1	0	

140	5	2	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	1	2	1	p	1	3	26	1	0	
141	4	2	n		n	p	p	p	n	p	p	n	n	n	n	n	0	0	0	0	n	N	0	2	3	1	p	1	3	21	0	0	
142	3	1	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		23	1	0	
143	7	1	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	1	p	0		34	1	0	
144	9	2	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		23	1	0	
145	8	2	n		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		22	1	0	
146	6	2	n		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		17	1	0	
147	7	2	n		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	1	2	2	p	2	3	24	1	0	
148	8	2	n		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		26	1	0	
149	8	1	n		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	1	2	1	p	1	3	34	1	0	
150	9	1	n		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		26	1	0	
151	7	2	n		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		17	0	0	
152	6	1	n		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	1	2	1	p	1	3	17	0	0	
153	5	2	p	2	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		18	0	0	
154	4	2	p	2	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		24	0	0	
155	3	1	p	2	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		24	1	0	
156	3	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		34	1	0	
157	4	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	1	p	1	3	35	1	0	
158	5	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		26	0	0	
159	6	1	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		24	1	0	
160	7	1	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	1	n	N	0	0	0	0	n	0		23	1	0	
161	8	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	2	3	3	p	1	3	24	1	0	
162	9	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	0	p	0		26	1	0	
163	8	1	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	1	n	Y	0	2	3	1	p	1	2	25	1	0	
164	5	1	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	1	p	1	3	16	1	0	
165	7	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	1	p	1	3	25	0	0	
166	3	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	0	p	0		35	0	0	
167	12	1	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	2	p	3	3	16	0	0	
168	11	1	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		18	0	0	

169	3	2	p	2	n	p	p	p	p	n	n	n	n	n	n	n	0	1	0	0	n	N	0	2	3	2	p	1	3	25	1	1	0
170	5	2	p	3	n	p	p	p	p	n	n	n	n	n	n	n	0	1	0	0	n	N	0	2	3	2	p	1	3	25	1	1	
171	6	2	p	2	n	p	p	p	p	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	2	p	1	3	35	1	1	
172	8	1	p	1	n	p	p	p	p	n	n	n	n	n	n	n	0	1	0	0	n	N	0	2	3	3	p	1	3	34	0	1	
173	7	2	p	1	n	p	p	p	p	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	0	p	0		25	1	0	
174	9	1	p	2	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	1	n	N	0	1	2	2	p	2	3	16	1	0	
175	8	1	p	3	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	1	n	N	0	1	2	0	p	0		15	1	0	
176	6	1	p	2	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	1	n	N	0	1	1	1	p	2	3	17	1	0	
177	5	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	1	p	0		25	1	0	
178	4	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	2	2	p	2	3	27	1	0	
179	7	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		26	0	0	
180	8	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		26	0	0	
181	3	1	p	1	n	p	p	p	n	n	n	n	p	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		24	0	0	
182	11	1	p	1	n	p	p	p	n	n	n	n	p	n	n	n	0	1	0	1	n	N	0	0	0	0	n	0		16	0	0	
183	12	2	p	1	n	p	p	p	n	n	n	n	p	n	n	n	0	1	0	0	n	N	0	0	0	2	p	0		24	1	0	
184	3	2	p	1	n	p	p	p	n	n	n	n	p	n	n	n	0	1	0	0	n	N	0	0	0	2	p	0		27	1	0	
185	4	2	p	1	n	p	p	p	n	n	n	n	p	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		34	1	0	
186	5	1	p	1	n	p	p	p	n	n	n	n	p	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		25	0	0	
187	6	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		16	1	0	
188	7	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		17	1	0	
189	8	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		18	1	0	
190	9	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		34	1	0	
191	4	1	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	0	0	0	n	0		25	1	0	
192	3	1	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	0	0	n	0		26	1	0	
193	6	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	0	0	n	0		16	0	0	
194	7	2	p	1	n	p	p	p	n	n	n	n	n	n	n	n	0	1	0	0	n	N	0	1	0	0	n	0		28	0	0	
195	8	1	p	1	n	p	p	p	p	n	n	n	n	n	n	n	0	1	0	0	n	N	0	2	0	0	n	0		34	0	1	
196	3	2	p	1	n	n	n	n	p	n	n	n	n	n	n	n	0	1	0	0	n	N	0	2	0	0	n	0		26	0	1	
197	4	2	p	1	n	n	n	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	1	0	0	n	0		37	1	0	

198	5	1	n		n	p	p	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		28	1	0	
199	6	1	n		n	p	p	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		36	1	0	
200	7	1	n		n	p	p	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		24	0	0	
201	8	2	n		n	p	p	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		34	1	0	
202	9	1	p	1	n	n	n	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		24	1	0	
203	3	1	p	1	n	n	n	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		26	1	0	
204	4	1	n		n	p	p	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	1	2	1	p	1	3	16	1	0	
205	5	1	N		n	p	p	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	1	2	2	p	1	3	17	1	0	
206	6	1	P	1	n	n	n	n	n	n	n	n	n	n	n	n	0	0	0	1	n	N	0	1	2	2	p	2	3	18	1	0	
207	7	1	N		n	p	p	n	n	n	n	n	n	n	n	n	0	0	0	1	n	N	0	1	2	2	p	2	3	19	0	0	
208	8	2	P	1	n	n	n	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	1	2	2	p	3	3	27	0	0	
209	9	2	N		n	p	p	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	1	2	1	p	1	3	26	0	0	
210	12	2	P	1	n	n	n	n	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		32	0	0	
211	11	1	N		n	n	p	n	n	n	n	n	n	n	n	n	0	0	0	1	n	N	0	0	0	0	n	0		18	0	0	
212	3	2	N		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		19	1	0	
213	4	2	N		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		24	1	0	
214	5	2	N		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		30	0	0	
215	6	1	N		n	p	p	p	n	n	n	n	n	n	n	n	0	0	0	1	n	N	0	0	0	0	n	0		27	1	0	
216	7	2	N		n	p	p	p	p	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		38	1	1	
217	8	1	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		27	1	0	
218	9	2	N		n	p	p	p	p	n	p	n	n	n	n	n	0	0	0	0	n	Y	0	2	3	2	p	1	2	28	0	1	
219	8	2	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		18	0	0	
220	3	1	N		n	p	p	p	p	n	p	n	n	n	n	n	0	0	0	0	n	N	0	2	3	4	p	1	3	19	1	1	
221	4	2	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		36	0	0	
222	5	2	N		n	p	p	p	p	n	p	n	n	n	n	n	0	0	0	0	n	N	0	2	3	4	p	1	3	28	0	1	
223	6	2	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		35	0	0	
224	7	2	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		19	0	0	
225	8	2	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		32	1	0	
226	11	2	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		24	1	0	

227	10	2	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		25	0	0	
228	3	1	N		n	p	p	p	n	n	p	n	n	n	p	n	0	0	0	0	n	N	0	0	0	0	n	0		21	0	0	
229	4	1	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		35	1	0	
230	6	2	N		n	p	p	p	n	n	p	n	n	n	p	n	0	0	0	0	n	N	0	0	0	0	n	0		35	1	0	
231	5	1	N		n	p	p	p	n	n	p	n	n	n	n	n	0	0	0	0	n	N	0	0	0	0	n	0		24	1	0	
232	7	2	N		n	p	p	p	n	n	p	n	n	n	p	n	0	0	0	0	n	N	0	0	0	0	n	0		34	1	0	
233	8	1	N		p	p	p	p	n	n	p	n	n	n	n	n	0	0	2	0	n	N	0	0	0	0	n	0		23	1	0	
234	9	1	N		p	p	p	p	p	n	p	n	n	n	n	n	0	0	2	0	n	N	0	2	3	3	p	2	3	25	1	1	
235	7	1	N		p	p	p	p	p	n	p	n	n	n	n	n	0	0	2	0	n	Y	0	2	3	3	p	1	2	16	0	1	
236	6	1	N		p	p	p	p	p	n	n	n	n	n	n	n	0	0	2	0	n	Y	0	2	3	2	p	1	2	17	0	1	
237	5	2	N		p	p	p	p	p	n	n	n	n	n	n	n	0	0	1	0	n	N	0	2	3	4	p	1	3	26	0	1	
238	7	1	N		p	p	p	p	n	n	n	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		35	0	0	
239	5	1	N		p	p	p	p	n	n	n	n	n	n	n	n	0	0	1	1	n	N	0	0	0	0	n	0		27	1	0	
240	6	2	N		p	p	p	p	n	n	n	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		28	1	0	
241	4	1	P	1	p	n	n	n	n	n	n	n	n	n	n	n	0	0	1	1	n	N	0	0	0	0	n	0		29	0	0	
242	3	1	N		p	p	n	n	n	n	n	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		40	0	0	
243	7	1	N		p	n	p	n	n	n	n	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		32	1	0	
244	8	1	P	1	p	n	n	n	n	n	n	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		30	1	0	
245	9	2	N		p	n	p	n	n	n	n	n	n	n	n	n	0	0	1	0	n	N	0	0	0	0	n	0		30	1	0	
246	4	2	P	2	p	n	n	n	n	n	n	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		35	1	0	
247	3	1	P	2	p	n	n	n	n	n	n	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		24	1	0	
248	6	1	P	2	p	n	n	n	n	n	p	n	n	n	n	n	0	1	1	0	n	N	0	0	0	0	n	0		26	1	0	
249	6	1	P	2	p	n	n	n	p	n	p	n	n	n	n	n	0	1	1	0	n	N	0	2	3	4	p	1	3	27	1	1	
250	9	1	P	2	p	p	p	p	p	n	p	n	n	n	n	n	0	1	1	0	n	N	0	2	3	4	p	1	3	30	0	1	
251	4	1	P	2	p	p	p	p	p	n	p	n	n	n	n	n	0	1	1	0	n	N	0	2	3	4	p	1	3	23	1	1	
252	4	2	P	1	p	p	p	p	p	n	p	n	n	n	p	p	0	1	1	0	n	N	1	1	2	2	p	2	3	16	1	5	
253	6	1	P	1	p	p	p	p	p	n	p	p	n	p	p	p	0	1	1	0	n	N	2	1	2	3	p	3	3	54	2	4	1
254	8	1	P	1	p	p	p	p	p	n	p	n	n	p	p	p	0	1	1	0	n	N	1	1	2	2	p	2	3	15	1	5	0
255	9	2	P	1	p	p	p	p	n	n	p	n	n	p	p	p	0	1	1	0	n	N	1	0	0	0	n	0		24	1	5	

256	12	2	P	1	p	p	p	p	n	n	p	n	n	p	n	n	0	1	1	0	n	N	0	0	0	0	n	0		26	1	0	
257	5	2	P	1	p	n	n	n	n	n	n	n	n	p	p	n	0	1	1	0	n	N	1	0	0	0	n	0		17	1	5	
258	6	1	P	1	P	n	n	n	n	n	n	p	n	p	n	n	0	1	1	1	n	N	3	0	0	0	n	0		48	1	3	1
259	4	1	P	1	P	n	n	n	n	n	n	p	n	p	p	n	0	1	1	1	n	N	4	0	0	0	n	0		43	1	2	1
260	5	2	P	1	P	n	n	n	n	n	n	p	n	p	n	n	0	1	1	0	n	N	7	0	0	0	n	0		50	2	3	1
261	6	2	P	1	P	p	n	n	n	p	n	p	n	p	p	p	0	1	3	0	n	N	6	3	3	3	p	3	3	59	1	3	1
262	10	1	P	2	P	p	n	n	n	p	n	p	n	p	n	n	0	1	0	0	n	N	3	3	3	3	p	1	3	70	1	3	1

KEY TO THE MASTERCHART

A-Code

B-Age

C-Sex 1-male 2 -female

D-Fever

P- present N-absent

E-Duration

< 1 week – 1 1 week – 2

>1 weeks – 3 >2 weeks – 4

>3 weeks – 5

F-Abdominal pain

p-present n-absent

G-Dysuria

P-present N-absent

H –Urgency

P-present N-absent

1-Frequency of micturition

P-present N-absent

J-Hematuria

P-present N-absent

K-Pyuria

P-present N-absent

L-Persistant vomiting

P-present N-absent

M-previous urinary tract surgery

P-yes N-no

N-constipation

p-yes N-no

O-pallor

p-yes n- no

P- Facial puffiness

p-yes n-no

Q-Pedal edema

p-yes n-no

R-Blood pressure

0-normal 1-high

S-Temperature

0-normal 1-high

T-per abdomen

0-normal 1- suprapubic tenderness 2-lumbar tenderness

3-other area tenderness

U-genitourinary examination

0-normal 1-phimosis 2-vulval adhesions

V-external markers of neural tube defect

p-present n-absent

W-Catheterisation

P-yes n - no

X-Associated comorbidity

0-no comorbidity, 1-nephrotic syndrome, 2-neurogenic bladder, 3-posterior urethral valve, 4- primary vesicourethral reflux, 5-hydronephrosis, 6-hydroureteronephrosis, 7-PUJ obstruction

Y-urine microscopy

0-no pus cells, 1-(0-5), 2-(5-10), 3-(10-15)

Z-leukocyte esterase

0-negative, 1-+, 2-++,3-+++,4-++++

AA-nitrite

0-negative, 1-+, 2-++,3-+++,4-++++

AB –Leukocyte esterase /nitrite

p-positive

n-negative

AC-Urine culture

0-no growth , 1-ecoli , 2-klebsiella , 3-proteus , 4-citrobacter , 5-non fermentative gram neg bacilli , 6-pseudomonas

AD-Colony count

1- <100 2-100-100000 3-100000

AE –Urea

AF- Creatinine

AG- USG Abdomen and Pelvis

0-normal 1-cystitis 2-pelvicalyceal system dilatation

3-hydroureteronephrosis 4-neurogenic bladder 5-ascitis

AH- MCU

0-normal 1-abnormal

ETHICAL COMMITTEE APPROVAL LETTER

MADURAI MEDICAL COLLEGE
MADURAI, TAMILNADU, INDIA -625 020
(Affiliated to The Tamilnadu Dr.MGR Medical University,
Chennai, Tamil Nadu)

Prof Dr V Nagaraajan MD MNAMS
DM (Neuro) DSc.,(Neurosciences)
DSc (Hons)
Professor Emeritus In Neurosciences,
Tamil Nadu Govt Dr MGR Medical University
Chairman, IEC

Dr.M.Shanthi, MD.,
Member Secretary,
Professor of Pharmacology,
Madurai Medical College, Madurai.

Members

1. Dr.K.Meenakshisundaram, MD (Physiology)Vice Principal, Madurai Medical College

2. Dr.Sheela Mallika rani, M.D., Anaesthesia , Medical Superintendent ,Govt. Rajaji Hosptial, Madurai

3.Dr.V.T.Premkumar,MD(General Medicine) Professor & HOD of Medicine, Madurai Medical & Govt. Rajaji Hospital, College, Madurai.

4.Dr.D.Maruthupandian, MS., Professor & H.O.D. Surgery, Madurai Medical College & Govt. Rajaji Hosptial, Madurai.

5.Dr.G.Meenakumari, MD., Professor of Pathology, Madurai Medical College, Madurai

6.Mrs.Mercy Immaculate Rubalatha, M.A., B.Ed., Social worker, Gandhi Nagar, Madurai

7.Thiru.Pala.Ramasamy, B.A.,B.L., Advocate, Palam Station Road, Sellur.

8.Thiru.P.K.M.Chelliah, B.A., Businessman,21, Jawahar Street, Gandhi Nagar, Madurai.

ETHICS COMMITTEE CERTIFICATE

Name of the Candidate	:	Dr.Anurega Selvaraj
Course	:	PG in MD., Paediatrics
Period of Study	:	2015 - 2018
College	:	MADURAI MEDICAL COLLEGE
Research Topic	:	Use of urine dipstick as a rapid screening tool for evaluation of UTI in children.
Ethical Committee as on	:	26.10.2016

The Ethics Committee, Madurai Medical College has decided to inform that your Research proposal is accepted.

Member Secretary Chairman Dean / Convenor

DEAN
Madurai Medical College
Madurai-20

26 OCT 2016

ANTI PLAGIARISM CERTIFICATE

URKUND

Urkund Analysis Result

Analysed Document: uti final.docx (D31188539)
Submitted: 10/10/2017 4:08:00 PM
Submitted By: anurega.selvaraj@gmail.com
Significance: 1 %

Sources included in the report:

Final thesis.docx (D30790588)
Thesis copy for plagiarism check.docx (D31130304)

Instances where selected sources appear:

4

CERTIFICATE

This is to certify that this dissertation work titled "**A STUDY ON USE OF URINE DIPSTICK AS A RAPID SCREENING TOOL FOR EVALUATION OF UTI IN CHILDREN**" of the candidate **DR.ANUREGA SELVARAJ** with registration number **201517102** for the award of MD degree in Branch **VII- PAEDIATRIC MEDICINE**. I personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion pages and the result show 1 percentage of plagiarism in the dissertation.

Guide & Supervisor sign with seal